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Estimation of the Value of Time Spent on NHS Waiting Lists using Stated Preference Methodology

by
CAROL PROPPER

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Carol Propper

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The Author

Carol Propper was a Lecturer in Economics, Brunel University at the time this research was completed. She is currently at SAUS, University of Bristol and is a Visiting Research Fellow in the Centre for Health Economics at the University of York.

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ABSTRACT

The length of waiting lists for treatment in the British National Health Service is an issue of current economic and political concern. This paper presents estimates of the costs to consumers of waiting lists for non-urgent medical care. The estimates are derived from data collected using 'Stated Preference' methodology, widely used to establish values of time in transportation, but previously little applied to the field of health care. The paper discusses the issues involved in using such a methodology to estimate the costs of waiting lists, presents estimates of this cost and discusses the applicability of these estimates to cost benefit evaluation in the U.K. health care market.

INTRODUCTION

In much health care research, data are often not available in the precise form required by the researcher. This problem can sometimes be overcome through the use of data from secondary sources. In other cases, the data required can be collected by means of a survey, asking relevant groups to report their actions. However, in some cases, no observed data exists because of the very nature of the problem. For example, it is not possible to estimate the price elasticity of demand for care in a health care system in which price at point of demand is set equal to zero. Yet the non-existence of data does not mean the problem the researcher wishes to examine is trivial or unimportant. For example, some knowledge of price elasticities would be central to an ex-ante assessment of the impact of a policy to introduce user charges on a larger scale within the NHS. In such situations the only course of action open to the researcher may be to use data based on stated intentions rather than observed actions. The aim of this paper is to discuss the collection and use in health care research of a data set based on stated intentions.

The purpose of the research described here was to derive estimates of the value of the time spent on waiting lists for non-urgent medical treatment by the demanders of care. The aim was to derive estimates from data on trade-offs made by demanders of care between time and money. The nature of the NHS system meant that these trade-offs could not be observed with sufficient precision to allow estimation of the value of time, so values were sought from data based upon stated intentions to trade-off time and money.

The organisation of the paper is as follows. In Section 1 we discuss the nature of the costs of waiting lists for demanders of medical care. In Section 2 we briefly review the economic foundations of the research, the data requirements and the relative merits of data based on stated intentions and data based on observed actions. In Section 3 we look in more detail at the specific issues that have arisen in the collection of and use of 'intentions' data of the current study. These issues include the choice of type of question, the choice of a context within which respondents were asked to make choices and the selection of appropriate respondents. The econometric model is presented in Section 4 and the estimates of the value of time spent on waiting lists for non-urgent medical care are presented in Section 5. The paper concludes with a discussion of the use of the Stated Preference methodology in health care research.

1. THE COSTS OF NHS WAITING LISTS

It is widely recognised that time has an important role in the allocation of medical care, particularly in health care systems in which allocation by money price is relatively unimportant. Various aspects of this 'generalised' cost of medical care have been studied, and recently attention has been drawn to the specific role and costs of waiting lists (Lindsay and Feigenbaum 1984; Cullis and Jones 1985, 1986; Iversen 1987). It is widely accepted that queueing in person has a positive cost to the queuer. In contrast, Lindsay and Feigenbaum (1984) (herafter LF) have argued that the time spent on a list has no cost; the costs of a waiting list occur only because the good to be received is worth less if received later rather than sooner. This decrease in value of the good is not due only to a positive rate of time preference, but is also the consequence of the attributes of the good itself. The rate at which the value of the good to be received falls with time is referred to as the 'decay rate'. Individuals will join a waiting list up to the point where the discounted value of the good to be received, where the discount rate is the decay rate, is equal to the fixed cost of joining the list. The length of time spent on a list is only important because the decay rate is not zero.

LF have used this model to analyse differences in length of waiting list for medical treatment in the British National Health Service (NHS). They argue that differences in lengths of waiting lists for different treatments are soley the result of differences in decay rates. While it may be the case that differences in decay rates account for some of the differences in length of waiting lists, such differences do not preclude a positive cost to the wait itself. In this paper we advance and test the hypothesis that waiting per se results in disutility for the waiter and further, that it is possible to derive an estimate of the monetary value of this disutility.

While having to wait for medical treatment does not necessarily prevent the demander of care from carrying out some work or leisure pursuits, being on a waiting list for medical care (as distinct from being on a list for, say, season tickets to a baseball game) may be associated with costs which are unrelated to the decay rate of the treatment. By definition, an individual on a waiting list is in less good a state of health than his or her 'normal' state. Being in this state may both decrease the utility of some uses of time and/or prevent the individual from undertaking some of his or her her usual activities. In addition, many individuals on waiting lists may not know the final waiting time at the outset of their wait. Waiting is therefore associated with uncertainty, which will impose a cost for the risk averse. Finally, individuals may be anxious about the outcome of their treatment. The longer they have to wait, the greater the total amount of anxiety they will experience. The effect of waiting lists can perhaps therefore be modelled as decreasing the utility of a subset of all utility producing activities, so that waiting per se gives rise to disutility for the demander of care. The intention of the present research is to derive a set of estimates of the value of the disutility of a unit of time spent on a waiting list for non-urgent medical treatment. These estimates are to be derived from trade-offs individuals make between length of waiting list and money cost. Using these estimates, we can also derive an estimate of the total costs of waiting lists for the consumers of care.

To estimate a monetary value of the disutility of waiting list time the economic basis for measuring the disutility of waiting list time must be established. In addition, the proposed model must have properties which permit empirical estimation from the type of data which is available. These issues are discussed in greater detail elsewhere (MVA et al. 1987; Propper 1988) and in this paper we only provide a brief outline of the economic model, concentrating instead on methodological issues in the collection and estimation of the model.

2. THE ECONOMIC FRAMEWORK

2.1 Micro-economic theory of the value of time

In the first discussion of the economics of time, Becker (1965) proposed that the standard direct utility function of the consumer, with commodities as the arguments, be respecified in terms of activities, each of which has a certain requirement in terms of both commodities and time. Consumers face a total time constraint of 24 hours per day, so time enters the indirect utility function, but is not an argument of the direct utility function. De Serpa (1971) assumed that direct utility is derived from a vector of commodities, plus a vector of time spent in various activities (the effect on utility of the components of the time vector can be either negative or positive). The individual maximises utility subject to a set of constraints. First, there are budget constraints on income and the total amount of time. Second, de Serpa introduces the idea of a 'technologically' fixed amount of time required for the consumption of each commodity. The formal model has the following form:

$$\max \quad U = U(\underline{x}, \underline{t})$$

$$\text{s.t.} \quad \underline{p} \cdot \underline{x} \leq Y \qquad [\ \lambda\ ]$$

$$\textstyle\sum_j t_j \leq T \qquad [\ \mu\ ]$$

$$t_j \geq t_j^* \text{ , for all } j \qquad [\ \Psi_j\ ]$$

where

U = utility function

Y = total income

T = total time available to consumer

$\underline{x}$ = vector of goods

$\underline{t}$ = vector of time spent in activities

t_j = time spent in activity j

t_j^*= technologically determined amount of time for activity j

μ = lagrangean multiplier for total amount of time

Ψj = lagrangean multiplier for time used in activity j

λ = lagrangean multiplier for income

From the first order conditions of the model, de Serpa obtained expressions for the 'marginal valuation of time' spent in any activity. For activity j, this is the ratio of the marginal utility of time spent in activity j to the marginal utility of income and is given by

$$(\delta U / \delta t_j)/\lambda = \mu/\lambda - \Psi_j/\lambda \qquad (1)$$

where the sysmbols are as defined above.

The marginal valuation of time in activity j therefore represents the consumer's willingness to pay for a unit of time in activity j. It is a function of the difference between the opportunity cost of time per se (from the constraints on total time) and the marginal value of saving/reducing time spent in activity j (from the technological constraints).

In the economics of transport, interest has focused upon the value of reduction of time spent on transit mode j. From equation (1) this is

value of time saved in activity j = resource value of time
- valuation of time spent in activity j.

There has been some discussion as to whether it is possible to distinguish between the two separate components that make up the value of time saved in activity j (Bates 1987; Truong and Hensher 1987). In this research we have followed Bates who argued that the resource value of time (the value of pure leisure) and the marginal valuation of time spent in activity j are theoretical constructs that can not be separated in empirical estimation. In estimation, the analyst can only derive estimates of the value of reducing time spent in activity j. For activities which give disutility, the marginal valuation of time spent in the activity will be negative, so the value of time saved will be greater than the resource value of leisure time.

The de Serpa model provides a basis for estimation of the value of the marginal unit of time saved in the context in which the demander can choose any level of the arguments of the utility function. For the analysis of the use of time spent in a transit mode, and in the current research, the possibilities of empirical measurement of the value of time are confined almost entirely to situations involving choices between discrete alternatives. For example, in transit a consumer can choose only one mode of transit at one time. In our case, an individual in need of medical care can either choose to wait on a list until called into hospital or to 'go private', in which case the wait is generally zero. He cannot trade off units of waiting time and units of money at the margin. Given this type of data it is necessary to use a model appropriate to situations of discrete choice.

Truong and Hensher (1985) (hereafter TH) extended the de Serpa framework to permit analysis of discrete choice. They derive an indirect utility function of the form

$$V_j' = \max U' (G_j, L_j, t_j) \quad (2)$$
$$= V' (\lambda, \mu, \Psi_j)$$

where G_j = quantity of generalised consumption good (after deducting cost of time spent in activity j)

L_j = quantity of generalised time (after deducting time spent in activity j)

t_j = time spent in activity j

λ = lagrangean multiplier for income

μ = lagrangean multiplier on leisure time

Ψ_j = lagrangean multiplier on time spent in activity j (due to technological constraint)

The valuation of time spent in activity j is given by

$$(\mu - \Psi_j)/\lambda \quad (3)$$

which can be rearranged to give the value of relaxing the technological constraint on the time spent in activity j.

A simple form for the indirect utility function of equation (2) is

$$V' = a + \lambda(Y - c_j) + \mu T - \Psi_j t_j \quad (4)$$

where

c_j = cost of activity j

other symbols as above

Once the indirect utility function is defined, a probabilistic choice model can be formulated to permit estimation. The random utility model (McFadden 1980, 1974) is used extensively in transport economics and was used in the current research. If this model is used to examine choice between two alternatives, terms common to both alternatives can be dropped from the specification of the deterministic component of utility.

This general framework was adopted to analyse the value of time saving in health care. We made the assumption that the deterministic element of the random utility model for the choice between two health care alternatives which have different waiting times and costs can be specified as

$$V_j = -\lambda c_j - \Psi_j t_j \qquad (5)$$

where c_j is the cost, and t_j the length of waiting time for alternative j. The coefficients λ and Ψ_j are derived from estimation and can be interpreted as scale transformations of the marginal utilities of cost and time respectively (Fowkes and Wardman 1988). The ratio of the coefficients can be interpreted as the value of saving waiting time in health care choice j.

The Becker and de Serpa analyses and extensions thereto all assume that the uses of time are mutually exclusive. These models do not address the question of non-exclusive uses of time. Waiting for care on a waiting list is a non-exclusive use of time. However, as an individual on a waiting list for medical care is in a state of health that is less good than his normal state, being on a waiting list does have an effect on the individual's allocation of time. Being ill may both decrease the utility of some uses of time and/or actually prevent the individual from undertaking some of his normal uses of time at all. Within the de Serpa framework, the effect of being on a waiting lists can perhaps be modelled as both decreasing the utility of time spent any activity and increasing the number of technological constraints that are binding. We therefore assumed that a valuation of a unit of waiting time can be derived from the estimation of a model of discrete choice between alternatives characterised by different monetary costs and different lengths of waiting list time.

2.2 Statistical requirements

To estimate the opportunity cost of time spent on waiting lists we required data from which we could infer the time and money attributes of the alternatives faced by consumers. In addition, the variables considered relevant (waiting time and money cost) should show a fair degree of variation. To identify the most important sources of any variability in waiting list time, we required background socio-economic data on individuals making these trade-offs. Further, to estimate the model with any degree of precision, we required a sample in which a reasonable proportion of observations choose each alternative.

Unfortunately, there is little observed (also referred to as revealed preference) data which could be used for the estimation of the value of waiting list time. Individuals cannot be observed making choices from which their values of waiting time can be deduced, because of the type of choices faced by consumers in the UK health care market. For illnesses for which waiting lists are used to allocate care, demanders either have to go on waiting lists or they may opt out of the NHS into the private sector. They cannot make trade-offs between money and time at the margin. The most the observer could infer from choices between waiting and 'going private' is that the total costs of waiting on a list are less than the costs of private treatment for the demander who stays in the

NHS and the obverse for the demander who chooses to go private. However, even this inference may not be possible. From the behaviour of demanders the observer cannot know how long the waiting list would have been for those who chose to leave. In addition, the demander who chooses to stay in the NHS may not have had information at the outset on the length of wait. If he/she underestimated the length of the wait, he/she may have preferred, ex-post, to have 'gone private' at the beginning. It therefore does not seem possible to infer the value of time from the observed actions of health service users with any great precision or confidence.

The alternative approach is to ask respondents to make choices between alternative courses of action within a hypothetical context and use the responses as measures of preference. In the current research, the alternatives put before the respondents would be designed to elicit measures of preference over time and money. From respondents' choices estimates of the value of waiting time could be derived. In seeking measures of preference in a hypothetical choice context, two types of method are commonly used. The first, labelled by Tversky et al. (1987) as 'matching', requires the respondent to state the amount of an attribute (such as money) which will make him/her indifferent between the two alternatives he/she has been asked to choose between. The second method requires the respondent to rate or rank pre-specified alternatives. This is commonly referred to as 'Stated Preference' (hereafter referred to as SP). The analyst designs a set of hypothetical alternatives based on a limited set of attributes considered to be important and obtains from the respondent an indication of his/her relative preference for each of the alternatives. The simplest indicator of preference is the selection of one alternative from a two options (labelled 'choice' by Tversky et al. 1987). The exercise is then repeated a number of times, systematically altering the values of the attributes. Stated Preference methodology has been widely used in the economic analysis of the value of transit time. (The Journal of Transport Economics and Policy, volume 22, 1 (Jan 1988) carries extensive discussion on its use in this field). The methodology has been used in the health care field to determine the preference of demanders about the location and type of supplier of health care (Parker and Srinivasan (1976); Wind and Spitz (1976)).

The advantages of an experimental design are that the researcher can collect information closer to that required by the research than the information which can be derived from revealed preference data. In addition, the researcher may use the questionnaire design to minimise the variance of the parameters of interest, so reducing the size of sample required. The disadvantages are primarily those associated with other questionnaire methods, such as reliability and validity, and the difficulty of inferring actual behaviour from answers given to hypothetical choices. In the current context, the lack of revealed preference data from which trade-offs between waiting time and cost could be inferred meant that reported, rather than observed, actions were the only possible sources of data. Of the hypothetical options, the Stated Preference methodology was chosen in preference to the matching approach on the grounds that the choice task was probably easier for the respondents, so increasing the likelihood of reliable and valid responses.

3. STATED PREFERENCE DESIGN

The research aim was to derive estimates of the value of the disutility of time spent on waiting lists for diseases with zero decay rates, using data from trade-offs between money and waiting time made by respondents within a hypothetical, but hopefully not unrealistic, context. The core of the experimental design was the specification of a set of pairs of alternatives, each alternative characterised by a particular level of waiting time and money cost and any other attributes considered important. The central issues in the design were the selection of attributes for the alternatives, the numerical values for these attributes, the hypothetical context and the selection of respondents. These issues are interrelated; for example, the choice of hypothetical context is in part determined by and determines the choice of attributes and the value of attributes.

3.1 Choice of attributes

The number of attributes which can be incorporated in each alternative is limited by the ability of respondents to distinguish between different alternatives. In addition, there is a trade-off between the number of attributes and the number of numerical values that each attribute can take. To keep the number of replications to a minimum we restricted our focus to three attributes. As the aim of the research was to estimate the money value of a unit reduction in waiting list time, two of the attributes were obviously time and cost. These were specified in months and in pounds respectively. Since we wished to investigate whether the value of waiting time was systematically related to uncertainty over the length of the wait, the third attribute chosen was uncertainty of date of admission. This was specified as a dummy variable with value 1 if the date of admission was uncertain and value 0 otherwise.

3.2 Numerical value of attributes

Choice of the numerical values of the attributes was determined by a number of factors. First, as this study was, to our knowledge, the first to attempt to measure the value of waiting time for non-urgent medical treatment in the UK, we wished to allow for a wide range of values of time to be implicit in the choices respondents would make. Second, we wished to take advantage of the experimental design to limit the variance in the parameters of interest. Third, we felt it necessary to limit the number of choices each respondent would be faced with (each choice required the respondents to indicate preference for one of two alternatives). After considerable piloting the final set contained 14 pairwise choices.

We also wished to investigate non-linearities in the choice making process. Research using the stated preference approach in transport has indicated that utility differences might not be linear in attribute differences, but may be a function of the levels of the attributes (Bates and Roberts 1983). This non-linearity has been termed a 'threshold' effect. It was thought that threshold effects might arise in the context of a choice between waiting time and monetary cost because individuals might not feel able to trade off between time and cost at high level of cost. In other words, at high values of cost, choice would become lexicographic, alternatives being rated in terms of their money values rather than all their attributes. To permit investigation of lexicographic choice and other possible departures from the choice making process assumed in the random utility model underlying the research, two sets of replications were used. Each respondent was allocated at random only one set. The two sets (referred to as the 'Pink' and 'White' sets respectively) are presented in Table 1. The ratio of waiting time to money cost in the pairs of alternatives (the replications) in two sets is similar, but the levels of both time and cost attributes are higher in Pink Set. The cost and time values of replications 1-8 in this set are 50 percent higher than the cost and time values for the same replications in the White Set. This subset of replications was used to examine whether threshold effects are present. Replications 8-11 were identical in the two sets. Replications 12-14 had three functions; to make the average ratio of time to money similar in the two sets, to attempt to capture very high or

Table 1

Values used in StatedPreference Replications

Replication	'White' Set			'Pink' Set		
	Cost	Time	Uncertainty	Cost	Time	Uncertainty
1	100	4	1	75	3	1
2	100	6	1	75	5	1
3	100	12	0	75	9	0
4	200	4	0	150	3	0
5	200	6	1	150	5	1
6	400	4	1	300	3	1
7	400	6	0	300	5	0
8	400	12	1	300	9	1
9	800	4	0	800	4	0
10	50	6	0	50	6	0
11	770	11	1	770	11	1
12	75	2	1	600	6	1
13	160	5	0	160	4	0
14	530	8	0	480	12	0

Cost in £, time in months, uncertainty has value 1 if exact admission date not known, 0 otherwise.

very low values of time and to provide data for further tests of lexicographic choice.

3.3 Hypothetical context

If the present health care market were used as the context, the individual would be asked to choose between immediate private care at a positive money cost and NHS care with either a definite or an indefinite wait. The advantage of the above context is its familiarity, but it has serious drawbacks. These arise primarily because waiting time is not perceived as the only difference between the two options. Extensive piloting showed that respondents appeared to associate the two alternatives with differences in attributes which were not part of the research design. For example, respondents stated in pilot interviews that they considered that the private option provided more privacy and had better hotel facilities. Choice between alternatives therefore could have been made on the basis of these attributes, rather than on the basis of a trade off between time, uncertainty and cost. Additionally, some respondents felt that the cost values were too low to be realistic costs of current private sector treatment, so rendering the choice process unrealistic.

To overcome these problems, it was decided to set the trade-offs in a framework of choice between immediate treatment at some positive cost in an NHS hospital and treatment after some positive wait in the same NHS hospital at zero money cost. The scenario within which respondents were asked to make their choices explicitly stated that treatment, nursing care and recovery were identical in both alternatives. It was specified that the cost of the first alternative was not intended to finance the total cost of care, but simply a sum that could be paid to avoid the queue. To examine the effects of uncertainty over the date of admission on the value of waiting time, the wait was specified as either known or uncertain. If uncertain, the length of wait had a known mean and a uniform distribution around that mean. The pilot work showed that respondents appeared to understand the context and that the two options differed only in terms of cost, time and uncertainty.

The choice of one of the two alternatives had to be made within the context of a need for non-urgent medical treatment. We had the option of either specifying a particular medical condition or describing the features of an unspecified condition. The second course was chosen. Use of a specific condition as the context has the advantage that the researcher can be sure that respondents are making the trade-offs in a known context only if it is certain that all respondents have the same understanding of the context. If some respondents have no experience of the named condition and/or some respondents have different experiences to others, the advantages of a specific named condition are lost. It was felt this might occur in this case, particularly as the type of conditions which could be named (i.e. for which waiting lists exist) can be fairly sex specific (e.g. hernias, varicose veins).

The hypothetical context was specified along the following lines. The respondent was asked to imagine that he/she had a medical condition which required an operation. Prior to this operation (implicitly the only treatment possible) the respondent would not be able to perform all his/her normal activities and would have to take a specified amount of time away from work or from household duties. The condition would not deteriorate during a wait, but neither would it improve. Once the operation was performed, the respondent's health would return to normal. It was hoped that respondents would view this situation as associated with minimum anxiety over the possibility of deterioration of health status during the wait. As a check of understanding of the context, the respondents were asked whether they had made their choices with a specific condition in mind, and if the response was positive, to name the condition.

3.5 Selection of respondents

It was expected that the value of the disutility of waiting time would vary across respondents, for example, with income, socio-economic status, past or present health care, health status and political views as to the proper role to be played by the private sector in the provision of health care. Details on all these factors were collected as part of the survey and we consider hypotheses about variation in estimates of the value of waiting time across respondents in more detail below. Here we consider the choice between selection of respondents from individuals currently on waiting lists or from the whole population. The value of waiting time of the former group is essentially an ex-post valuation. In cost benefit analysis generally there is a view that the correct valuation is the ex ante valuation. Accordingly, we drew a sample from a random cross-section of the population of England and Wales. (A professional survey organization drew the sampling frame and conducted all the fieldwork[1]). It was thought that ex-post valuations would probably be higher than ex-ante valuations, but as we collected detailed data on recent and current utilization of the health care services, we could examine this hypothesis directly. To avoid inclusion of individuals who have no knowledge or experience of waiting lists and to whom the hypothetical choices could be meaningless, we excluded individuals under 25. Individuals over 70 were also excluded, as it was thought that this age group might include some individuals who found the task too difficult and so give unreliable responses.

4. MODEL SPECIFICATION

The basic model to be estimated is an extension of equation (5), incorporating the attribute uncertainty over date of admission. For any individual i, the deterministic component of random utility of option j is given by

$$V'_{ij} = \alpha_j + \beta C_j + \gamma T_j + \delta W_j \quad (6)$$

where α_j is a constant reflecting aspects of the option considered important by the respondent which are omitted in the rest of the model and C_j, T_j and W_j represent the cost, time and uncertainty over date of admission of option j (fixed by design across respondents). (Note the change in case for C_j and T_j). On the basis of the theory outlined above, the ratio of the time and cost coefficients in this model can be interpreted as the utility value of a unit reduction in the time spent on a waiting list.

In moving from the individual specification of equation (6) to an aggregate specification, it is reasonable to expect non-random variation in the parameters. For example, different individuals face different cost and time budget constraints and so are likely to have different coefficients β, γ and δ. To allow for non-random variation in the model parameters it is necessary to segment the model on the basis of those characteristics of the individual believed to account for differences in the coefficients. The simplest form of segmentation is to estimate a given model separately for each group or segment in the sample. However, this approach not only requires large sample sizes to obtain well defined coefficient estimates, but will introduce unnecessary distinctions between segments if some of the coefficients do not differ across segments. The alternative approach is to estimate a single model using all observations, but to reformulate the form of the model using dummy variables to permit different coefficients for different segments. (For details see Propper (1988)).

In principle, each variable in the SP design matrix could be segmented by one or more factors but this can lead to a very large set of coefficients which have to be estimated. Estimation of such a large set of parameters is fairly onerous, so we adopted the simplifying assumption that there are no interaction effects between the different factors on which segmentation is based. In the terminology of general linear models we only considered additive effects (McCullagh and Nelder 1983).

4.2 Identification of segments

The decision to segment certain variables and the selection of the individual attributes by which segments are defined should be based on theoretical hypotheses about the nature of likely variation of the coefficients within the sample. In the current research, we segmented the data to reflect the likely impact of budget constraints on the choices individuals can make. We assumed that the marginal utility of income falls as income increases and therefore segmented the cost coefficient by income. We assumed that the time variables varied non-randomly with the opportunity cost of time spent on waiting lists, and so segmented the time variable on the basis of socio-economic activity and household responsibilities (defined as a single composite factor, rather than two separate factors). The uncertainty variable was segmented on the basis of several additive factors, chosen to measure the disutility an individual might derive from uncertainty over the date of admission for hospital treatment. These factors were current and past health care utilization and health status, to investigate whether those in poorer health would get more disutility from uncertainty over the date of receipt of treatment, and health insurance cover, on the grounds that those who currently buy health insurance are more likely to dislike the uncertainty imposed by waiting lists than those who do not have insurance.

The constant term of the model is an indicator of the respondent's willingness to pay to avoid a wait. It should not be interpreted as a measure of the relative benefits of private care over NHS care in the present health care system, as the scenario explicitly states that medical treatment and nursing care are identical whether the respondent choose to pay or to wait and pilot work indicated that this appeared to be clear to respondents in the pilot samples. We expected the constant term to vary systematically with factors that might predispose individuals to avoid waiting, specifically, income and beliefs about the role that should be played by the private sector in the provision of health care. Thus the constant term was segmented by these two factors (again assuming no interaction between the factors).

With these segementations equation (6) can be re-expressed, for individual i, as

$$V_{ij} = \alpha_j + \sum_{p=1}^{P-1} d_{ip}\alpha_p + \sum_{m=1}^{M-1} d_{im}\,\alpha_m$$

$$+ \sum_{m=1}^{M} d_{im}\,\beta_m C_j + \sum_{k=1}^{K} d_{ik}\,\gamma_k T_j - \delta W_j \qquad (7)$$

where j indexes the option, i the individual, p views about the role of the private sector in the health care market, m the income group, k employment status group, C_j is the cost of option j, T_j is the time of option j, W_j is the uncertainty associated with option j and the d_{ip}, d_{im}, d_{ik} are dummy variables such that

$$d_{is} = \begin{cases} 1 & \text{if individual is in segment } s \\ 0 & \text{otherwise} \end{cases}$$

$$s = p, m, k$$

5. MODEL ESTIMATION

5.1 Checks for violations of underlying behavioural model

The model assumed to underlie the choice between alternatives permits only random error. Error that is correlated with one or more of the attributes will result in inconsistent estimates of the value of waiting time. It is therefore important to attempt to identify individuals whose choice process might depart from that assumed by the random utility model and to test for misspecification by estimating the model with and without this group. The questionnaire was designed to allow the researcher to make checks for different types of error. First, after completion of the Stated Preference exercise, respondents were asked two 'Transfer Price'(TP) (or 'matching') questions. Both questions referred to the same scenario as the SP questions. In one respondents were given a waiting time for treatment and asked to state the minimum sum of money they would be prepared to pay to avoid this wait. The other was the reverse of this; respondents were presented with a monetary sum and asked to state the minimum wait which they would be prepared to accept rather than pay[2]. Second, as noted above,the SP set was designed to allow the researcher to search for evidence of lexicographic choice.

From patterns in their responses to the questions, certain respondents appeared to making choices in a manner that could be inconsistent with behavioural assumptions of the choice model. Most of these completed the SP task, but their responses to the 'matching' questions suggested they may not have been making trade-offs between attributes. The first group were respondents who gave the response 'couldn't pay' or 'wouldn't pay' to the TP questions. Of these, the former were perhaps indicating that they did not have the income to play the SP game; the latter that they would not play the game. Data collected as part of the survey indicated that the former group had significantly lower incomes than all other respondents in the sample, while the latter group were significantly more likely to agree with the statement that no private health care should permitted. The second group were those respondents who appeared to be making lexicographic choices.

At most, under 30 percent of the sample were identified as possibly choosing on some basis which might not conform to the random utility model. Most of these were individuals who did not complete the TP questions: 5 percent were excluded on the basis of the response 'couldn't pay' to the 'matching' questions, 25 percent on the basis of the responses 'wouldn't pay', 'don't know' or 'not answered' to the TP questions, and 4 percent on the basis of lexicographic choice. Some of those who did not give a response to the TP question did choose both pay and wait alternatives in the SP exercise; others always chose the wait option. Comparison of the models estimated using and not using the data from this group provides a test of the effect of violation of underlying behavioural assumptions.

5.2 **Model estimation**

All models were initially estimated using only one of the two SP data sets. Several specifications of the segmentation variables were tested, estimation was undertaken using nested data sets derived by omission of some of the pairs of replications and the models were estimated with and without the observations which appeared to be violating the behavioural model. Estimation of a preferred model using the data from one set of SP questions and applying this model to the data from the other set is one test of model stability, and comparison of the models estimated using a subset of the SP questions with those estimated using all SP questions is another. Model selection was made on the basis of formal and informal tests. These included score tests for normality (Bera, Jarque and Lee 1984), likelihood ratio tests of nested models and pairwise comparison of coefficients.

The results indicate that models with segmentation on the time, cost and intercept variables fit significantly better than those with no segmentation (in terms of both explanatory power and departure from the assumption of normally distributed errors), and the assumption of a normal distribution of errors is violated slightly less for models estimated using all observations. These results hold for different definitions of the sample of observations, for subsets and the full sets of SP replications and for different specifications of the parameters of the model. The proportion of correctly predicted responses is about 70% for most of the data subsets. The parameter estimates for both sets of SP replications are similar in magnitude and pattern across segments. The coefficients, with the exception of those for uncertainty, are generally well defined, of the expected sign and similar in all the data subsets.

The preferred estimates are given Table 2 for the White set and Table 3 for the Pink set. These models were estimated without those observations which may not have been making choices on the basis of the underlying behavioural model. Research in the transit literature has indicated that inclusion of respondents who appear to be violating the assumptions of the behavioural model may result in biased estimators and/or poorly defined coefficients (Fowkes and Wardman 1988). Our analysis indicated that inclusion of those respondents discussed in section 5.1 resulted in a better fitting model on some criteria, but a poorer fitting model on others. The results from estimation with all respondents are presented in the Appendix as Tables 5 and 6. The score tests for normality indicate less misspecification in these models. However, the differences in the score test statistics are not large and although the coefficients on the time and cost variables are higher in Tables 2 and 3,

Table 2

White Set: Non-choosers on TP Questions and Lexicographic Choosers Omitted

(n = 341)

Variable	Coefficient	Std. Error	T-Ratio	Mean of Variable
ONE	1.015	0.941 E-01	10.78	1.0000
D1	-1.085	0.965 E-01	-11.23	0.25806
D2	-0.5091	0.920 E-01	- 5.53	0.52786 E-01
P1	-0.4369	0.911 E-01	- 4.79	0.46334
P2	-0.1924	0.416 E-01	- 4.62	0.46334
C12	-0.2748 E-02	0.108 E-03	-25.39	240.55
C3	-0.2390 E-02	0.190 E-03	-12.52	65.523
T1	0.1133	0.790 E-02	14.34	3.6950
T2	0.9602 E-01	0.978 E-02	9.81	1.0557
T3	0.5447 E-01	0.979 E-02	5.56	0.99916
T4	0.1161	0.112 E-01	10.36	0.67868
U	-0.8203 E-02	0.405 E-01	- 0.20	0.50000

Loglikelihood	-2575.3
Normality	15.07 (5.99)
Skewness	14.58 (3.84)
Kurtosis	3.19 (3.84)

D1 dummy variable with value 1 for lowest income group
D2 dummy variable with value 1 for middle income group
P1 dummy variable with value 1 if believe no private health sector should exist
P2 dummy variable with value 1 if believe private sector should only operate outside NHS
C12 cost x lowest and middle income group dummy
C3 cost x highest income dummy
T1 time x fulltime employed dummy
T2 time x part-time employed dummy
T3 time x housewife dummy
T4 time x retired dummy
U uncertainty dummy with value 1 if there is no certain admission date

Table 3

Pink Set: Non-choosers on TP Questions and Lexicographic Choosers Omitted

(n = 344)

Variable	Coefficient	Std. Error	T-Ratio	Mean of Variable
ONE	1.042	0.888 E-01	11.73	1.0000
D1	-1.023	0.905 E-01	-11.30	0.31319
D2	-0.4473	0.880 E-01	- 5.07	0.46703
P1	-0.3989	0.806 E-01	- 4.95	0.68681 E-01
P2	-0.1354	0.408 E-01	- 3.31	0.49176
C12	-0.2684 E-02	0.103 E-03	-25.97	238.80
C3	-0.2223 E-02	0.177 E-03	-12.52	67.268
T1	0.9712 E-01	0.786 E-02	12.34	3.3693
T2	0.1154	0.101 E-02	11.38	0.93407
T3	0.8791 E-01	0.929 E-02	9.46	1.2510
T4	0.1155	0.121 E-01	9.48	0.51707
U	-0.1667 E-01	0.391 E-01	0.42	0.50000

Loglikelihood	-2777.9
Normality	47.85 (5.99)
Skewness	43.28 (3.84)
Kurtosis	1.85 (3.84)

D1 dummy variable with value 1 for lowest income group
D2 dummy variable with value 1 for middle income group
P1 dummy variable with value 1 if believe no private health sector should exist
P2 dummy variable with value 1 if believe private sector should operate outside NHS
C12 cost x lowest and middle income group dummy;
C3 cost x highest income dummy
T1 time x fulltime employed dummy
T2 time x part-time employed dummy
T3 time x housewife dummy
T4 time x retired dummy
U uncertainty dummy with value 1 if there is no certain admission date

the ratios of these coefficients, which are the point estimates of the value of time, are very similar in the two sets of estimates.

The main difference between the estimates derived with and without these observations are in the size of the constant term and in the variance covariance matrix of the parameter estimates. The constant terms and the standard errors of the estimates are smaller in the estimates of Tables 2 and 3 than in Tables 5 and 6. The differences in the constant terms indicate that the excluded group are more likely to choose the wait option, which was expected given that many of the excluded group only chose this option. The stability of the value of time estimates between the two sets of estimates, together with the differences in the intercept terms, perhaps indicates that the source of misspecification reflected in the score tests for normality in Tables 2 and 3 may be the result of omission of variables which measure the propensity to choose the wait option. As our primary interest was in the time and cost coefficients, we felt it was not necessary to model these differences in the intercept term further.

As our preferred estimates, we selected those with the best fit in terms of the estimates of the value of time. This model was that with the smaller variance covariance matrix and was therefore the model estimated without the respondents discussed in section 5.1 above. The discussion below therefore applies to the estimates presented in Tables 2 and 3. However, it is worth stressing that the estimates of the Appendix are not dissimilar in magnitude, are of the same sign and are similar in precision.

5.3 Cost coefficients

The pattern of coefficients of the cost variable indicated that those with a higher income have a lower marginal valuation of cost. The segments were defined by gross household income of less than 150 pounds per week, between 150 and 349 pounds per week and 350 pounds and over. Pairwise tests of coefficients for different segments indicated that differences between all three income groups were not statistically significant in all models, and the segmentation could be reduced to distinguish between respondents with household incomes of below and above 350 pounds per week[3]. (Individual income was also used to define segments on this variable, but loglikelihood ratio tests indicated a better fit when household income was used).

5.4 Time coefficients

The time coefficient was segmented by a factor with four levels, these being the full-time employed, the part-time employed, full-time housewives and the retired. Segmentation on the time variable generally seemed to reflect the extent of alternative uses of time spent on a waiting list whilst in a state of health below the normal level. The coefficient for the employed was higher than the coefficients for housewives. Healthy time may be more important to those who have to work in both household and market production. (The presence of children in a household did not appear to affect the coefficient of the time variable). In the White set (Table 2) the time coefficient for the part-time employed is smaller than, although not significantly different from, the time coefficient for the full time employed. In the Pink set (Table 3) the higher coefficient for the part-time employed is rather surprising. This result may stem from the presence in the part-time employed segment of a group of self-employed. In other analyses of the data (not shown here) the self-employed had a significantly higher time coefficient than the employed.

The high (relative) coefficient on time for the retired contrasts with studies of value of time savings in transport, in which the retired are found to have lower time variable coefficients (MVA et al. 1987).

This may be the result of the different nature of the two goods. The disutility of extra time in a transport mode is low to the retired, who generally do not have fixed schedules or face many constraints on their daily allocation of time. However, when time is measured in units of months rather than minutes and waiting is associated with a lower health status, the retired may place a higher value on each month because their expected stock of months is smaller than that of younger individuals. The retired may therefore derive greater disutility from being on a waiting list than other individuals with the same income.

It is interesting to note that the students in the sample (who were excluded from the main analysis on the grounds of small numbers) had high values of time relative to housewives. Again, this result contrasts with findings in the economics of transport and again, the result may stem from the difference between transport and health care. Students have relatively few time constraints on the uses of their time on a daily basis, but do have periods of the year in which time loss probably has a high disutility (such as the examination period). Hence, they may place a high value on short waiting times. In addition, because good health may be desired for the future as well as the present, students may consider the income constraint they face to be that of their families/parents, or related to their future expected income, rather than that defined by their current income.

5.5 Uncertainty coefficients

The coefficient on the uncertainty variable was insignificant in almost all specifications of the model. The uncertainty variable was segmented by various measures of health status (current health rating, worry about health, recent utilization of in- or out-patient hospital services) and by health insurance cover (whether or not the respondent had cover) to identify groups might deri[illegible] different amounts of disutility from uncertainty. None of the estimated segment-specific coefficients was significantly different from zero. This may reflect the relative unimportance of uncertainty of admission date in a situation in which individuals are faced with choices which involve large sums of cost or long waits. In other words, whether or not the actual admission date is known or only known to within a two month range is irrelevant. The choice is dominated by the values of the time and cost variables. However, this result may also be due to the particular specification of the uncertainty variable in the SP design.

Uncertainty was specified as the wait option having an uncertain date of admission, within a known two month band. So, for example, respondents would be told that under the wait option they could be admitted at any time between four and six months hence. Technically, uncertainty was specified as a random admission date from a uniform distribution which had a range of one month either side of the mean. However, respondents might have differed in the way they interpreted this variable. Some might have assumed that they would not be admitted until the end of the range, others might have assumed that they would be admitted at the earliest possible date. If the distribution of respondents' interpretations were random, then the assumption made in model estimation that the mean date of admission was the mean of the distribution given in the SP replications would be correct. However, if the distribution of assumptions about the length of wait under uncertainty were not random, then the specification used in model estimation would be incorrect.

5.6 The alternative specific constant

There are significant differences in the propensity to choose to pay rather than wait between respondents. The dummy variables on the intercept term for political attitudes indicates that those who agreed with the statement that no private care should be permitted were significantly less likely to pay than those who agreed with the statement that private care should only be allowed outside the NHS. The latter group were in turn significantly less likely to pay for care than those who felt that the private sector should be allowed to operate both inside and outside the NHS (the omitted dummy). The dummy variables for income indicate that the lowest income group were significantly less likely to chose the pay alternative than the middle income group who were in turn less likely to choose this alternative than the highest income group (the omitted dummy).

5.7 Estimates of the value of time

The estimates of the values of the utility of a unit reduction in waiting list time for all models are presented in Table 4. This table indicates that the values of time are significantly different from zero for all segments. The value of time of the lower income groups in both sets is below that of the higher income groups and the value of time of housewives below that of the retired and the employed. The standard errors of the estimates indicate that the estimates from the two sets of replications do not differ significantly. The standard errors indicate that the value of time for the full time employed, the part-time employed and the retired do not differ significantly from each other in either set. However, it was felt that the stability of the direction of the estimates was some indication of a pattern across segments and the large standard error for the higher income, retired group was in part a consequence of the small numbers in this segment. Accordingly, the segmentation between the employed, the retired and housewives was retained although it appears that the employed could be treated as one, rather than two, groups. Collapsing all segments, we obtain a single value of waiting time from each set of

Table 4

Estimated Value of Waiting List Time (#/month)

Segment	White set	Pink set
Weekly household income below #350		
Full time employed	41.90 (2.75)	36.51 (2.69)
Part-time employed	35.70 (3.45)	43.07 (3.56)
Housewife	20.40 (3.97)	32.93 (3.22)
Retired	43.43 (3.97)	43.32 (4.28)
Weekly household income above 350		
Full time employed	49.43 (4.81)	44.73 (4.64)
Part-time employed	42.11 (5.09)	52.75 (5.92)
Housewife	24.06 (4.41)	40.33 (5.02)
Retired	49.90 (5.04)	53.01 (6.67)
Average across all segments	37.69 (2.70)	38.17 (2.68)

Standard errors in parentheses.

Note

Standard errors calculated from Taylor series approximation to the variance of a function of random variables. Letting

$$var(b_1/b_2) = 1/b_2^2 \; [var(b_1) - 2(b_1/b_2)cov(b_1,b_2) + b_1^2/b_2^2 \; var(b_2)]$$

If b_1 = coefficient for time variable, b_2 = coefficient for cost variable, b_1/b_2 = VoT, then

$$var(VoT) = 1/b_2^2 \; [var(b_1) - 2 \; VoT \; cov(b_1,b_2) + VoT^2 \; var(b_2)]$$

replications (presented at bottom of Table 4). The estimates for each set differ significantly from zero, but do not differ significantly between the two sets. The average cost per month for the four groups considered here ranges between 32.39 and 42.99 pounds in the White set (95 percent confidence interval around the mean). Comparison of the estimates of the model using all observations with those derived from estimation excluding those respondents who may have been violating the behavioural assumptions of the random utility model indicates that the estimates from the smaller sample are slightly, but not significantly, higher. As many of the excluded group selected the wait option in all replications, this result is as expected.

As discussed above, students, the sick, the unemployed and those looking for work were excluded because there were too few in each category to create a segmentation and it was felt that it was incorrect to group together these different groups into an 'other' category. How inclusion of this group would affect the value of time is not clear, as although they have lower income, the value of time appears to be a function of both income and the constraints on time and the constraints on this group are not necessarily lower than those of richer groups. Finally, this research has estimated the disutility of waiting list time in the least costly waiting situation; the wait for treatment of a medical condition with a zero decay rate. To the extent that waiting lists exist for conditions which have a positive decay rate, this figure will be an underestimate of the value of time spent waiting.

5.8 Comparison with previous estimates

Cullis and Jones (1986) assumed that there are 38.64 million weeks of waiting on non-urgent list in the NHS per annum. Using the Lindsay and Feigenbaum framework and the 1985 prices of private medical care, they estimate the cost of waiting to be between 1,205 and 2,155 million pounds per annum. Taking their figure for weeks of waiting on the NHS, assuming 4 weeks in a month, and equating the value of time saving estimated here with the costs of time spent on a waiting list, our estimates suggest a total cost in the order of 370 million pounds per annum. These results indicate that the Cullis and Jones 'ballpark' is perhaps too high. One reason the Cullis and Jones figures are high is they assumed that distribution of costs of waiting to be uniform with a lower bound of zero and a upper bound equal to the full cost of private care. However, given that purchase of private care depends on ability to pay and so income, and that income has a log-normal rather than a uniform distribution, it might be expected that the distribution of values individuals are willing to pay is rather skewed towards zero. The estimates from the current research would appear to support this hypothesis. The implied cost per month in the Cullis and Jones 'ballpark' figure is between 110 (their lower estimate) and 220 (their higher estimate) pounds. Very few respondents in the current survey choose the pay alternative for the replication with a ratio of time to cost of 200 pounds and the numbers choosing this alternative for the replication with a ratio of 100 pounds was also small.

6. CONCLUSIONS

The coefficients of the estimated models are generally well defined and of a priori expected sign. The estimates of the value of waiting time are consistent across the two different sets of SP replications. They are similar to those derived from a series of SP questionnaires carried out as part of the pilot phase of the project using different sets of replications with different ranges of time to cost ratios and different methods of administration[4]. The results seem to indicate that some individuals do make trade-offs between time and cost and that these trade-offs could be used to give some indication of the value of time saved if certain types of waiting list were reduced. Unfortunately, we are not able to check the validity of our results by comparison with the findings of research other than the Cullis and Jones result. Few other researchers have attempted to measure the costs of waiting lists or to estimate the value of time spent waiting for medical care. None, to our knowledge, has used a Stated Preference Approach. The research has raised many issues, some of which still remain unresolved. We consider briefly two of these. The first concerns the design of SP questionnaires to estimate the value of non-traded goods in the NHS, the second the applicability of such valuations to decisions about resource allocation. The first is important for future applications of the SP methodology in estimation of values of time, the second central to the uses of such values.

While around 70 percent of the respondents in the sample appeared to complete the SP task in a manner consistent with the assumption that individuals would trade off time against cost, a significant minority of the sample might not have been making these trade-offs. While this has not resulted in substantially different estimates of the value of time, inclusion of this group increases the standard error of the estimates. The size of this group is important for future use of this methodology in the field of health care. For the purposes of questionnaire design, two distinct groups can be identified in this minority. The first group are those who may not have the income to be able to play the game as it was designed. We were well aware of this problem during the design stages of the research. However, the design was restricted by the need to place the choices within a framework which was close to that which respondents either have experienced or could see as possible. The nature of the health care system in the UK means that waiting lists have a duration of weeks or months rather than days, and that the costs of care outside the NHS is in terms of hundreds rather than tens or units of pounds. Specification of the alternatives as characterised by short waits and low cost, while overcoming the problem of those respondents who 'could not' pay, would set the SP choices within a framework which is a long way from current practice. This would only increase any problems of reliability and validity of responses. The pilot stages seemed to indicate that respondents felt that situations in which waits were short and costs low were less realistic than those characterised by longer waits and higher costs. The payment of money to avoid only the queue appeared comprehensible to most respondents in the pilot phase. (As patients can choose to see consultants privately and then be referred back into the NHS, this form of payment is perhaps not that far from current practice).

Nevertheless, within this framework, it was inevitable that certain individuals would not be able to afford to pay to avoid some of the waits. In a first attempt to use an SP methodology, it was not possible to divide respondents into groups on the basis of different values of time and administer two sets of trade off, one to each group, as there was no previous research on values of time on which to draw. To have segmented on income would have been imposing the assumption that the value of time was determined by income, an hypothesis we wished to test, rather than an assumption we wished to make. However, on the basis of the results of the current research, it might be desirable in future to divide the population into finer groups and design a different questionnaire for each group. As an example, in the SP work in transport, business travellers have been given SP replications with higher ratios of cost to time than leisure travellers (MVA et al (1987)).

This approach will not overcome the problem of those who do not wish to trade because they believe medical care should be free at the point of demand. The funding of the NHS by taxation, coupled with the importance of the NHS in UK political debate, means this problem is likely to be encountered whenever attempts are made to ask individuals to place a monetary value on aspects of the health system. One partial solution might to be to set the wait/pay tradeoff within a context of paying to cross boundaries and get treatment in another NHS region. However, in this case the responses could be affected by respondents' evaluation of the costs of being in hospital some distance from their home.

The second issue concerns the applicability of values derived from the current type of research to an evaluation of projects within the NHS. All the empirical results derived from the current research relate to behavioural costs. They are values which, given certain assumptions about the nature of preferences, best account for the reported behavioural intentions of the respondents. A behavioural value of time represents the money that an individual would be prepared to pay to save a unit of time for him/herself. As such, like values from revealed preference demand studies, the value is based upon ability to pay. The values are therefore derived within the particular normative framework of individual consumer sovereignty and private calculus. Other discussions of the costs of NHS waiting lists to demanders are also set within this framework and it is therefore useful for this research to have used the same framework. Our estimates can also be compared with the values of other types of time estimated by researchers using the same methodology and normative framework in different fields.

In contrast, an 'evaluation' value of time represents the amount of money a public agency would be prepared to pay to save a unit of time for an individual. The behavioural and evaluation values will differ whenever the welfare function used by the public agency differs from the sum of individual utility functions. Generally, the Social Welfare Function takes into account elements in the valuation which are not considered by the individual. Such elements include misperception of costs and benefits by the individual, factors causing a divergence between private and social cost, a difference in the individual and social rate of time preference.

The divergence between behavioural and evaluation values will depend on the number and extent of these elements and upon the notions of equity and distribution embodied in the SWF. We do not intend by our research to defend the consumer sovereignty approach on the grounds of equity. Rather, the private welfare calculus is often used as a starting point for valuation in cost-benefit analyses of public sector projects, so the behavioural valuation of waiting list time derived here be used as one starting point for the estimation of the evaluation value of waiting list time.

NOTES

1. All fieldwork was undertaken by a professional social survey organization, Social and Community Planning and Research (SCPR).

2. We were aware that the unfamiliarity of the second question could make it more difficult for respondents than the first.

3. Segmentation of the cost variable by two income groups defined by the median income resulted in similar model, but with a poorer fit as measured by the loglikelihood.

4. The SP replications of the pilot questionnaires had a lower range of implied value of time, in some time was specified in weeks rather than months and the questionnaires were self rather than interviewer administered. They were completed by two groups of employees in the York region and by conference and holiday visitors to York University in late 1985.

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Table 5

White Set: All Observations

(n = 491)

Variable	Coefficient	Std. Error	T-Ratio	Mean of Variable
ONE	0.812	0.796 E-01	10.20	1.0000
D1	-1.29	0.795 E-01	-16.31	0.35234
D2	-0.547	0.767 E-01	- 7.13	0.47658
P1	-0.785	0.680 E-01	-11.53	0.87576 E-01
P2	-0.264	0.349 E-01	- 7.54	0.46436
C12	-0.226 E-02	0.908 E-04	-24.97	253.71
C3	-0.195 E-02	0.167 E-03	-11.70	52.363
T1	0.935 E-01	0.636 E-02	14.71	3.3910
T2	0.700 E-01	0.791 E-02	8.85	1.0474
T3	0.485 E-01	0.809 E-02	5.99	0.0998
T4	0.668 E-01	0.860 E-01	7.77	0.89031
U	0.247 E-01	0.337 E-01	0.73	0.50000

Loglikelihood	-3705.7
Normality	6.2712 (5.99)
Skewness	5.9639 (3.84)
Kurtosis	4.5462 (3.84)

D1 dummy variable with value 1 for lowest income group;
D2 dummy variable with value 1 for middle income group;
P1 dummy variable with value 1 if believe no private health sector should exist;
P2 dummy variable with value 1 if believe private sector should operate outside NHS;
C12 cost x lowest and middle income group dummy;
C3 cost x highest income dummy;
T1 time x fulltime employed dummy;
T2 time x part-time employed dummy;
T3 time x housewife dummy;
T4 time x retired dummy;
U uncertainty dummy with value 1 if there is no certain admission date

Table 6

Pink Set: All Observations

(n = 517)

Variable	Coefficient	Std. Error	T-Ratio	Mean of Variable
ONE	0.777	0.743 E-01	10.46	1.0000
D1	-1.25	0.738 E-01	-16.95	0.39072
D2	-0.636	0.724 E-01	- 8.79	0.42940
P1	-0.546	0.617 E-01	- 8.85	0.90909 E-01
P2	-0.213 E-01	0.335 E-01	- 0.63	0.46809
C12	-0.296 E-02	0.854 E-04	-24.13	251.01
C3	-0.175 E-02	0.154 E-03	-11.35	55.057
T1	0.714 E-01	0.653 E-02	10.92	3.2060
T2	0.940 E-01	0.833 E-02	11.28	0.91600
T3	0.696 E-01	0.771 E-02	9.03	1.20356
T4	0.820 E-01	0.963 E-02	8.52	0.64590
U	0.227 E-012	0.323 E-01	0.70	0.50000

Loglikelihood	-4122.7
Normality	32.0 (5.99)
Skewness	29.6 (3.84)
Kurtosis	9.83 (3.84)

D1 dummy variable with value 1 for lowest income group;
D2 dummy variable with value 1 for middle income group;
P1 dummy variable with value 1 if believe no private health sector should exist;
P2 dummy variable with value 1 if believe private sector should operate outside NHS;
C12 cost x lowest and middle income group dummy;
C3 cost x highest income dummy;
T1 time x fulltime employed dummy;
T2 time x part-time employed dummy;
T3 time x housewife dummy;
T4 time x retired dummy;
U uncertainty dummy with value 1 if there is no certain admission date