The demand for private health care in the UK

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Abstract

Policy change has eroded the entitlement of UK residents to free state-provided health care, with a resulting rise in the use of the private sector. This paper examines the choice between public and private health care. It models the use of private health care as a function of its costs and benefits relative to state care and no care. The results indicate a difference between users of private care and other care, and the importance of past use as a predictor of current use. But they also show considerable movement between the public and private sectors, indicating a complex relationship in public and private sector use. © 2000 Elsevier Science B.V. All rights reserved.

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Keywords: Private health care; Public health care

1. Introduction

Health care in the UK is predominately state-financed. However, while approximately 85% of funding comes from the public purse, the use of private health care services is rising. While politicians have stressed their commitment to tax-financed free hospital care, policy change has reduced eligibility for publicly provided treatment, increased copayments for dental, ophthalmic services and pharmaceuticals, and reduced the payments made to independent contractors who provide state
financed dental care. These changes have been accompanied by a growth in the importance of the private sector in the provision of health care in the UK.

This growth could affect public provision (the NHS) in a number of ways. First, reductions in the availability of free care, particularly reductions which may not have been the intended consequence of policy, may affect whether NHS equity goals are being met. Second, the demand for private sector services affects the public sector. As in many health care systems in which the private sector operates alongside a larger public sector, labour in the NHS is also employed in the private sector, often simultaneously. In the short run, a significant expansion in private demand would reduce the availability of staff to the public sector and so reduce the quality of public sector services. More subtly, an increase in the use of private services may be accompanied by a decrease in the support for, and willingness to pay, taxes for the public sector. High private usage leading to lack of ‘voice’ and taxpayer discontent could lead to the evolution of the NHS into a ‘poor service for the poor’.

This last effect is likely to be less important if individuals who use private services continue to use the NHS at the same time and if the use of the private sector for one type of service is not linked to use of another. Given the piecemeal nature of policy change on the use of private finance in UK health care, this is perfectly possible: individuals may use both public and private services and may retain an overall strong commitment to the state financing of health care even though they are private service users. On the other hand, the changes in policy may have led to the development of a group of users who demand almost all their health care from the private sector and who have little commitment to public funding of health care.

A small body of research has identified the importance of income and political attitudes in the use of private health care services (Papadakis and Taylor-Gooby, 1987; Taylor-Gooby, 1989; Calnan et al., 1993). Propper (1989, 1993) found income and political beliefs affected the decision to buy private medical insurance. Besley et al. (1999) show a link between medical insurance purchase and quality of NHS services. This research has not been able to establish whether the distinct economic and social profile of private sector users is simply due to individual fixed effects or whether changes in income or attitudes would increase private sector use. Nor has any research examined the dynamics of private sector use: whether use is related to past demand, or whether current demand for one private service is accompanied by private demand for another.

This paper focuses on these issues. It estimates a model of the use of health care services which takes into account the choice a potential user of care in the UK has among the private sector, the NHS, and no care. It examines not only hospital and physician use but also the use of dental and other services based in the community. The estimated model allows past use to affect the costs and benefits of these alternatives. The data are from the British Household Panel Survey (BHPS), a nationally representative survey of around 5000 households.
interviewed each year since 1991. In terms of health care, and particularly private health care use, it is a rich data set. It contains information on medical need, on measures of political beliefs about the role of the public sector in the provision of health care, and on a large set of individual and household characteristics. In addition, it has data on health care utilisation that distinguishes between use of NHS and private services and, within private services, between those that are publicly funded and those that are paid out of pocket or by insurance.¹

The results indicate that use of private care is strongly related to income, a set of identifiable individual demographic characteristics and political attitudes. Private users are healthier than their NHS counterparts. Private use in the past is significantly associated with current use. Further, all these factors continue to be significantly associated with private use after controlling for unobserved individual effects. So, in this sense there is perhaps a definable ‘private welfare class’. On the other hand, private sector users do not live by private use alone. The results indicate considerable movement of individuals over time between the public and private sector. Current use of the private sector is positively associated with both past and future use of the NHS. Current use of the NHS increases the chances of future use of the NHS, and for some services, also increases the probability of use of private services in the future.

So, in addition to an understanding of who buys private health care, the paper also contributes to an understanding of the links between the private and public sectors in the UK. While there is considerable research on the link between public and private health care sectors in the American context (for example, Cutler and Gruber, 1996a,b), the amount of UK research is small. MacAvinchey and Yannopolous (1993) estimate a cost shares model using aggregate data in which they find significant cross-price elasticities between public and private care, Martin and Smith (1998) use ward level data and find an effect of waiting lists on demand for NHS elective surgery, and Besley et al. (1999) use microdata and find a positive relationship between waiting lists and private insurance. The results presented here show the patterns of association between public and private sector use to be quite complex. Private use in the past is more likely to lead to current private use than NHS use is in the past, but private service use in the past is also associated with NHS current use.

The paper is organised as follows. Section 2 presents an overview of private financed health care in the UK, and a description of the users of this care from the BHPS. Section 3 presents a model of the choice among use of private care, public care and no care, which motivates the demand for private care where a free public alternative exists. The econometric model derived from this model is then pre-

¹ This distinction is important as a significant component of UK government reform of the welfare sector has taken the form of contracting out of provision of services to the private sector, whilst maintaining public funding of these services.
sented. Section 4 presents estimates of the choice between the three alternatives. Section 5 focuses on the effect of past use and controls for individual effects. The final section discusses the results.

2. Private health care in the UK

Private expenditure on health care in the UK has grown from 9% of total health care expenditure in 1979 to 15% in 1995. This figure is made up of private medical insurance premiums (paid for by employers or individuals) and out of pocket expenditure on private medical services and goods. Out of pocket expenditure includes payment for inpatient private care, other hospital services, outpatient services, dental care, eye care, copayments for prescribed medicines and over the counter medicines.

Private provision of hospital services has always existed alongside the NHS. The 1991 NHS reforms attempted to give an incentive for the expansion of such care through tax relief on private medical insurance for the over-60s, but despite this, growth in private medical insurance has remained slow during the 1990s. On the other hand, policy change in dental and eye care appears to have had a bigger impact on private use. In 1985, NHS provision of glasses was restricted to certain groups (children, students under 19, individuals on low income, and users of certain complex lenses), and public provision was replaced the following year by vouchers. In dentistry, free dental check ups were restricted to the same groups in 1989. Although NHS treatment is supposed to be available to all, copayments (user fees) have risen. Changes to the level of fees paid to dentists who provide NHS care has led to widespread dissatisfaction amongst dental care providers, and to anecdotal evidence of a reduction in the dental services available under the NHS.

This paper examines the use of private services where an NHS alternative exists. In some cases this NHS alternative is free at point of demand. In other cases, eligibility rules mean certain groups are not entitled to free NHS care but NHS provision, with copayments for those not entitled to free care, is supposed to be available to all. The paper examines any use of private care and then focuses on two specific types of private health care service: inpatient hospital care and dental care. Private inpatient use is of interest because NHS quality measures, particularly waiting lists, are thought to be important in determining use, and if there is a link between these measures and private health care insurance it is through the (expected) use of private inpatient services. Dental services are of interest because, although all individuals are entitled to NHS dental care, it is argued the

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2 Private medical insurance primarily covers in- and out-patient hospital services.
availability of such care is being reduced by suppliers without any explicit change in government policy.

Table 1 shows the patterns in private demand for the different services for each of the first 5 years of the survey. Approximately 16% of individuals in the BHPS sample use either private dental, eye, hospital or outpatient services. The table indicates a general rise in private service usage across the 5 years of the survey, with only private inpatient use showing no growth.

3. The demand for private health care

3.1. The economic model

Goddard and Smith (1998) outline a simple model of demand for medical care where public and private care exists. This can be used to explore the impact of income, price and quality of the public alternative, attitudes to the role of state in the provision of health care, and past use on the current demand for private care. The model follows Goddard et al. (1994) in recognising that an individual has three discrete choices: to seek no medical care, to use private care, and to use public care. These choices will be affected by the severity of illness, the costs and the quality of NHS care, and the costs and quality of private care.

For any individual, indexed by \( i \), let \( V_i \) be the benefit of private health care and \( p_i \) be the cost (relative to income). The existence of the public sector constrains the suppliers of private care to providing a service which is of at least as high a quality as the public alternative: no one will buy the service if it is of lower quality than the public sector. Let this quality difference be represented by a single
parameter $\tau$. At its simplest, this can be waiting time but can be thought of more generally as encompassing other quality dimensions (such as the provision of information, or the ability to choose the exact date and location of treatment). Individuals vary in their valuation of this quality by the parameter $g_i$. If $\tau$ is thought of as waiting time, $g_i$ can be thought of as the rate at which the value of treatment decays because it is received later rather than sooner (Lindsay and Feigenbaum, 1984). The value of NHS treatment for individual $i$ is $V_i \exp(-g_i \tau)$.

NHS care has no direct user price but the individual has to access NHS facilities. Let this cost be $c_i$.

Faced with these costs and benefits, the potential user is indifferent between private and NHS care when

$$V_i - V_i \exp(-g_i \tau) = p_i - c_i$$  \hspace{1cm} (1)

is indifferent between private care and no care when

$$V_i = p_i$$  \hspace{1cm} (2)

and is indifferent between NHS care and no care when

$$V_i \exp(-g_i \tau) = c_i.$$  \hspace{1cm} (3)

Eqs. (1)–(3) can be used to examine the impact of changing parameters on the choice of the three alternatives. Decreasing $p_i$ will increase the use of the private alternative and decrease the use of the NHS and no care alternatives. Decreasing $c_i$ will increase the use of NHS treatment and reduce the use of private and no care. An increase in $g_i$ will increase the use of private care, reduce the use of NHS care and increase the use of no care. The effect of an increase in $\tau$ is the same. An increase in $V_i$ will increase the use of private care and NHS care.

These parameters will vary across individuals. The value of the benefits of medical treatment $V_i$ will obviously be related to the severity of illness. In addition, as $V_i$ is the perceived benefit to the user of care, it may also be a function of the importance of good health to the individual. This is often argued to be positively associated with education. Where $\tau$ is taken to be the waiting time for NHS treatment, $g_i$ is the individual’s valuation of time. This can be expected to be a positive function of income and of type of employment. For example, those who are self-employed are less likely to get paid whilst waiting for medical treatment. Where $\tau$ is the quality of the NHS, $g_i$ is the valuation of NHS quality. This might be expected to be a function of the individual’s general attitudes to the

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1 For an empirical estimate of the value of time in a medical context see Propper (1995).
NHS. For example, those who strongly value state provision of health care may be more tolerant of poorer quality. Then those who hold such attitudes will use more NHS services for a given value of $V_i$ and $\tau$.

The value of $p_i$ will be lower for those individuals who have medical insurance which covers the cost of private care and lower for those with higher income (since $p_i$ is defined relative to all other goods). Since $c_i$ is the access cost to NHS facilities, it will be lower, leading to greater availability of NHS facilities.

The nature of medical care means these prices will also be a function of past use of services. First, the price of care in each sector includes the costs of search. In health care, consumers cannot always tell good from poor quality. As a result, regulation limits advertising and consumers are reliant on their own knowledge and that of friends, relatives etc. As a consequence, search costs for a supplier of care may be high. Second, information asymmetries mean trust is an important component of the relationship between suppliers and demander of care. Third, an individual invests effort in communicating their medical history to a supplier of health care. So once an individual has found one supplier, they may be less likely to change to another. A consumer who has used the private sector in the past will have lower search costs for private sector use and will have made an investment with a private supplier. Similarly, a consumer who has recently used the NHS will have lower NHS care search costs and will have made an investment with an NHS supplier. So the costs of care in each sector are likely to be a function of past use, and current use is likely to depend upon past use.

3.2. The econometric model

At any time $t$, the individual chooses between private care, public care and no care. She thus has $J$ alternatives. Let $j = 1$ denote no care, $j = 2$ denote NHS care, and $j = 3$ private care. From the economic model of Eqs. (1)–(3), the latent net valuations associated with each alternative will depend on the characteristics of the individual (her valuation of health states, of time, of price etc.). The weight attached to each characteristic will vary by alternative. Allowing for random error, the latent net valuations of the $j$th choice can be written as:

$$ m_{ji}^j = \beta_j^i z_j + e_{ji} \quad (4) $$

where $z_j$ is a vector of attributes of the individual (which may be allowed to vary by alternative as well) and $e_{ji}$ is a random error term.\(^4\)

\(^4\)This model is of the form of the model of occupational choice of Schmidt and Strauss (1975).
If the individual is observed making choice \( j \), it is assumed that \( m^*_j \) has the highest net valuation. The statistical model is driven by the probability that choice \( j \) is made, which is

\[
Pr(m^*_j > m^*_k) \text{ for all } k \neq j.
\]

If the \( e_{ij} \) are assumed to be i.i.d. with Weibull distribution, then the statistical model that results for the choice of alternative is the multinomial logit model:

\[
Pr(m_i = j) = e^{\beta_i z_i} / \sum_{k=1}^{J} e^{\beta_i z_i}
\]

(5)

where \( m_i \) is the observed choice of individual \( i \). To estimate the parameters of this model it is necessary to normalise and impose the restriction that one of the \( \beta_j = 0 \). In estimation of this model, I impose the restriction that \( \beta_j = 0 \).

From the discussion above, the specific characteristics that will influence the choice the individual makes (i.e. the variables in \( z_i \)) include income and health status, the costs of accessing each service (which will be a function of the costs of private care, past use, and the availability of services) and the perceived quality of the public service (which will be a function of waiting lists and possibly attitudes to the public sector role in financing health care). In addition, there may be regional effects. So the latent net valuation of alternative \( j \) will depend on:

\[
m^*_j = f(X_i Q_i m_{j|i-1} R, e_{ji}), \quad j = 1,2,3
\]

(6)

where \( X_i \) is a set of personal and household demographics, socio-economic variables including income, and measures of the beliefs individuals hold about the appropriate role for the private sector in the provision of health care, \( Q_i \) a set of indicators of the quality of NHS provision in the region in which the individual lives, \( R \) a vector of regional dummies, \( m_{j|i-1} \) is use of alternative \( j \) last period, and \( e_{ji} \) is white noise error.

The data set records use at five time points and of several health services, denoted \( s \) (defined below). So the data permit examination of the impact of past use of one service on another and of past use of one alternative on another. To estimate these effects I pool the panel data and expand the set of variables in Eq. (6) to include these ‘cross-service’ and ‘cross-alternative’ effects and also to allow for time effects. The latent utility for alternative \( j \) of service \( s \) at time \( t \) is thus:

\[
m^*_{jst} = \beta_0 X_{it} + \beta_1 Q_{it} + \beta_2 m_{j|i-1} + \beta_3 m_{j'|i-1} + \beta_4 R + \beta_5 T + e_{jst},
\]

(7)

where \( m_{j|i-1} \) and \( m_{j'|i-1} \) are now vectors of past service use, \( j' \) indexes the other alternatives, \( T \) is a vector of time dummies, and \( e_{jst} \) is white noise error. From Eq.
(5) the parameter estimates will differ across the two alternatives but for simplicity of notation we have dropped the subscripts on these. As the restriction that the parameter estimates are 0 for alternative 1 (no care) is imposed, parameters are estimated only for alternatives 2 and 3. In pooling the data and conditioning on information at time \( t \), the assumption made is that the errors are not correlated over time for an individual. In addition, the MNL model imposes the assumption of independence of the errors across options.\(^5\)

3.3. The data

From the BHPS data I define the use of three services or sets of services. The first set of services is defined as use of any of the services given in Table 1 (dental care, eye care, inpatient stays, certain community services\(^6\)). If the respondent used any of these services in year \( t \) and any of her use was private, she is recorded as having positive private use in year \( t \). If she used any of these services and none of her use was private, she is recorded as having positive NHS use in year \( t \). The second service is an inpatient hospital stay. If this stay is privately paid for, the respondent is recorded as having a private stay. If the stay is not privately paid for, then she is recorded as an NHS user. The third service is dental care, where if the respondent has dental care and any of that care is private, she is recorded as having private dental care. If she has some dental care and none of it is private, she is recorded as having NHS dental care.\(^7\)

In addition to measures of health service use and standard socio-economic and demographic data for each individual in the household, the BHPS includes measures of current self-assessed health status, and detailed measures of longer term health status. Individuals are asked whether they are limited in their daily activities including work and leisure (ADLs). If they have any limitations they are asked whether these limit their ability to work. They are also asked what specific limitations/conditions they have. The data also record whether the individual is a smoker, and if the answer is positive the number of cigarettes consumed per day. Earlier research on the demand for private health care in the UK has either used no measures of health status (Besley et al., 1999), or rather more limited measures (Propper, 1993). Here the BHPS data are used to control for a large number of measures of health status. In addition, conditioning on health status enables a

\(^5\) While this is an unattractive feature of the MNL model, the rich set of regressor variables should reduce correlation between the errors.

\(^6\) These community services are all services for which NHS provision exists. The BHPS records use of other private services for which there is no NHS alternative. As we are interested in the choice between no use, NHS use and private use, we do not examine these services.

\(^7\) This coding gives the broadest definition of private use, which fits our interest in any use of the private sector.
reduction in the potential contamination of the income coefficient, which arises from the correlation between health and income. To these data are matched regional indicators of the quality of the NHS. These are the length of NHS waiting lists over- and under-12 months deflated by the regional population (relevant for inpatient care) and an index of dental service availability (relevant for dental care). The prices paid by individuals are not observed so the impact of price is not examined. As price at point of use for hospital inpatient services will depend on insurance coverage but the BHPS does not record private insurance cover, occupational dummies are included as instruments for corporate cover.

4. The determinants of private, NHS and no demand

A multinomial logit (MNL) model of the use of public and private care is estimated. Table 2 presents the estimates of the model where the omitted alternative is no care. The table presents separate results for the three sets of services defined above. Interpretation of the parameters in an MNL model is not straightforward, so instead of coefficient estimates, the table gives the estimated marginal effect of variable \( x \) on choice of alternative \( j \). The interpretation of the marginal effect is the impact of a unit change of the variable \( x \) on the choice of alternative \( j \). Table 2 presents the marginal effects for the choice of the private and the NHS alternatives. To show which variables have coefficients that are significantly different from 0, the \( z \)-statistics for the coefficient estimates are presented as well.

In general, the coefficients are well defined and indicate significant differences between users of the different alternatives. The results for the use of any care show that users of private care and users of NHS care share some demographic characteristics. Women are more likely to demand care in either sector than men, though the log-odds of private use compared to NHS use is lower for women. There is some indication that users of health care services in either sector rate their health as better health than the non-users of services. Individuals who smoke more, conditional on being smokers, are less likely to use either NHS or private services. These health status results perhaps reflect the fact that the any service set includes preventive services. Educational attainment is positively associated with use of both sectors, though the magnitude of the estimated marginal effects is

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8 These measures and the issues of possible endogeneity are presented more fully in Propper (1998).
9 A measure of the price of inpatient medical care is the average annual private insurance price. This varies by year but not by region. This measure was used in initial estimates, but had a small and insignificant coefficient estimate and therefore was dropped from subsequent analysis.
10 Besley et al. (1999) found that corporate health insurance cover varies by occupation.
11 The estimated marginal effects are \( \frac{\partial p_j}{\partial x} \). The relationship to the estimated \( \beta \) is \( \frac{\partial p_j}{\partial x} = p_j(\beta_j - \sum \beta_j) \) which depends on the estimated parameters for all the options.
<table>
<thead>
<tr>
<th>Any service use</th>
<th>NHS only</th>
<th>Private</th>
<th>Inpatient stay</th>
<th>NHS only</th>
<th>Private</th>
<th>Dental visit</th>
<th>NHS only</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>dp/dx (z-stat)</td>
<td>dp/dx (z-stat)</td>
<td>dp/dx (z-stat)</td>
<td>dp/dx (z-stat)</td>
<td>dp/dx (z-stat)</td>
<td>dp/dx (z-stat)</td>
<td>dp/dx (z-stat)</td>
<td>dp/dx (z-stat)</td>
</tr>
<tr>
<td>Gender</td>
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<td>0.002 (0.0)</td>
<td>0.024 (0.6)</td>
<td>0.001 (0.9)</td>
<td>0.03 (4.9)</td>
<td>0.005 (0.9)</td>
<td>0.01 (1.0)</td>
<td>0.001 (0.9)</td>
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<td>0.020 (5.3)</td>
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<td>0.004 (0.1)</td>
<td>-0.0010 (2.8)</td>
<td>-0.021 (7.3)</td>
<td>-0.060 (8.7)</td>
<td>0.03 (0.7)</td>
<td>0.005 (0.9)</td>
</tr>
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<td>Higher education</td>
<td>0.005 (3.0)</td>
<td>0.02 (4.6)</td>
<td>-0.005 (1.0)</td>
<td>-0.0013 (0.9)</td>
<td>0.012 (2.6)</td>
<td>0.0084 (2.8)</td>
<td>0.01 (1.0)</td>
<td>0.001 (0.9)</td>
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<tr>
<td>Age, Age², Family composition</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Self employed</td>
<td>-0.12 (5.1)</td>
<td>0.07 (1.1)</td>
<td>-0.06 (5.8)</td>
<td>0.0009 (0.1)</td>
<td>-0.063 (3.5)</td>
<td>0.031 (1.6)</td>
<td>-0.05 (1.5)</td>
<td>0.025 (1.7)</td>
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<tr>
<td>Employed</td>
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<td>0.05 (1.3)</td>
<td>-0.06 (5.8)</td>
<td>-0.0013 (0.5)</td>
<td>-0.05 (3.9)</td>
<td>0.025 (1.7)</td>
<td>-0.05 (1.5)</td>
<td>0.025 (1.7)</td>
</tr>
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<td>Public sector</td>
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<td>-0.01 (0.4)</td>
<td>0.004 (0.6)</td>
<td>0.026 (7.7)</td>
<td>0.0078 (0.4)</td>
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<td>0.0078 (0.4)</td>
<td>-0.0069 (0.7)</td>
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<td>Household income</td>
<td>-0.0003 (2.3)</td>
<td>0.0006 (9.2)</td>
<td>-0.0001 (3.0)</td>
<td>0.0008 (6.4)</td>
<td>-0.0001 (2.9)</td>
<td>0.000028 (4.4)</td>
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<td>0.000028 (4.4)</td>
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<td>Hhold income squared</td>
<td>2.66e-07 (0.3)</td>
<td>-4.18e-06 (4.3)</td>
<td>1.56e-07 (2.1)</td>
<td>5.75e-08 (3.8)</td>
<td>6.1e-08 (0.7)</td>
<td>-1.85e-07 (3.6)</td>
<td>6.1e-08 (0.7)</td>
<td>-1.85e-07 (3.6)</td>
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<tr>
<td>Industry dummies</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Health limits daily activity</td>
<td>-0.002 (1.5)</td>
<td>-0.02 (2.4)</td>
<td>-0.03 (6.9)</td>
<td>-0.003 (4.9)</td>
<td>0.012 (2.2)</td>
<td>-0.023 (2.3)</td>
<td>0.012 (2.2)</td>
<td>-0.023 (2.3)</td>
</tr>
<tr>
<td>Health limits work</td>
<td>-0.02 (1.5)</td>
<td>0.001 (0.8)</td>
<td>-0.03 (4.8)</td>
<td>0.005 (0.6)</td>
<td>0.026 (2.0)</td>
<td>0.012 (2.0)</td>
<td>0.026 (2.0)</td>
<td>0.012 (2.0)</td>
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<td>Smoker</td>
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<td>0.01 (1.8)</td>
<td>-0.009 (1.3)</td>
<td>-0.0004 (0.4)</td>
<td>0.03 (1.8)</td>
<td>0.002 (0.8)</td>
<td>0.03 (1.8)</td>
<td>0.002 (0.8)</td>
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<td>Number of cigarettes</td>
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<td>-0.0004 (2.2)</td>
<td>-0.0007 (2.0)</td>
<td>-0.00006 (1.0)</td>
<td>-0.003 (1.1)</td>
<td>-0.0003 (1.6)</td>
<td>-0.003 (1.1)</td>
<td>-0.0003 (1.6)</td>
</tr>
<tr>
<td>Other health controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Conservative party supporter</td>
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<td>0.04 (5.6)</td>
<td>0.00003 (0.0)</td>
<td>0.0017 (1.1)</td>
<td>-0.0004 (1.8)</td>
<td>0.020 (4.8)</td>
<td>0.00003 (0.0)</td>
<td>0.0017 (1.1)</td>
</tr>
<tr>
<td>Disagree w/ 'All health care should be free'</td>
<td>-0.003 (2.5)</td>
<td>0.01 (7.7)</td>
<td>-0.0010 (2.8)</td>
<td>0.0003 (0.3)</td>
<td>0.00033 (2.2)</td>
<td>0.00005 (2.2)</td>
<td>0.00033 (2.2)</td>
<td>0.00005 (2.2)</td>
</tr>
<tr>
<td>Disagree w/ 'Unfair money buys priority'</td>
<td>-0.004 (0.3)</td>
<td>0.005 (1.2)</td>
<td>0.0008 (5.9)</td>
<td>0.0017 (2.8)</td>
<td>-0.002 (0.5)</td>
<td>0.0013 (0.4)</td>
<td>0.0008 (5.9)</td>
<td>0.0017 (2.8)</td>
</tr>
<tr>
<td>Public use t-1</td>
<td>0.30 (43.3)</td>
<td>-0.015 (21.8)</td>
<td>0.09 (20.1)</td>
<td>-0.002 (0.3)</td>
<td>0.36 (65.0)</td>
<td>0.012 (25.3)</td>
<td>0.36 (65.0)</td>
<td>0.012 (25.3)</td>
</tr>
<tr>
<td>Private use t-1</td>
<td>0.02 (20.3)</td>
<td>0.24 (96.4)</td>
<td>0.004 (3.3)</td>
<td>0.026 (13.6)</td>
<td>0.105 (21.1)</td>
<td>0.19 (42.1)</td>
<td>0.105 (21.1)</td>
<td>0.19 (42.1)</td>
</tr>
<tr>
<td>% RHA resid waiting &gt; 1 year</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
</tr>
<tr>
<td>% RHA resid waiting &lt; 1 year</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
</tr>
<tr>
<td>Dental availability</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
<td>Yes (ns)</td>
</tr>
<tr>
<td>Regional dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-17.960</td>
<td>-66.30</td>
<td>-14.844</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sample size</td>
<td>21,002</td>
<td>20,962</td>
<td>20,598</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) z-Stats are for coefficient estimates and are calculated using robust standard errors. (2) Health controls are dummy variables for whether individuals have health problems with or suffers from the following conditions: limbs, sight, hearing, skin, chest, heart/blood pressure, stomach/digestion, diabetes, anxiety/depression, alcohol/drugs, epilepsy, and other conditions not specified in this list. (3) Public and private use t-1 are the last year’s use of the public and private sector, respectively of the dependent variable of the column for which the estimates are given.

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larger for the private alternative. Previous analyses of NHS use have also found a positive association between NHS use and education (sometimes argued to be evidence of middle class capture of the welfare state).

On the other hand, there are clear differences, in the expected direction, in the socio-economic characteristics of the users of the two sectors. Private users are less likely to live in social rented housing, and NHS health care users are more likely to do so. Being employed is negatively associated with use of public care, but positively associated with use of private care. Income is more heavily associated with use of the private sector than use of the NHS. Individuals who report that they are limited in their daily activities are less likely to use any private health services than to use the NHS.

There also appears to be a clear association between private use and political attitudes. Being a Conservative supporter is associated positively with private sector use and negatively with NHS use. Users of NHS services are slightly more pro-free care than non-users, but private users are significantly less supportive of the principles of the NHS. It is possible that these attitude measures are endogenous: individuals who use private services justify their use by holding relatively ‘anti’ NHS views. The endogeneity of these variables is investigated elsewhere (Burchardt and Propper, 1999) where it was found that, while private users hold less positive attitudes to the NHS, there is no clear evidence that private sector use leads to less support for the NHS than does NHS use.

It is possible also that these attitudinal variables are correlated with the regressors and with the error terms but play no casual role in health care decisions. To investigate this, the model was re-estimated constraining the coefficients on the party support and attitudinal variables to be 0. The coefficient estimates on the other variables changed very little and none of the changes were statistically significant. Therefore, conclude that the results are robust to inclusion of the attitudinal variables, and that these variables play an independent role in the choice of alternative.

There appears to be no clear association between the length of either waiting lists under a year or over a year and use of either alternative. The coefficient estimates of these variables were not significantly different from zero at conventional levels. Therefore, the marginal effects of these variables are not presented.

The estimates for inpatient and dental service use indicate demographic differences between users and non-users of these services. These, in part, reflect the type of service. For example, the demanders of dental care in either sector are younger, which may reflect the fact that dental care is in part preventative and those who are younger perceive more benefit from such care. There are also clear socio-economic differences between the users of private and NHS care for these two services. NHS inpatient users are less likely to be employed and are more

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12 These results are available from the author.
likely to live in social rented housing than either non-users or private users. NHS dental service users are poorer and less likely to be employed, reflecting the eligibility requirements for free dental check-ups. In terms of political attitudes, private inpatient users are less supportive of the equity principles of the NHS than either NHS users or non-users. For dental services, Conservative party support is positively associated with private use and negatively associated with NHS use. However, both NHS and private users of dental services are less supportive of the equity principles of the NHS than are non-users. This perhaps reflects the fact that users of dental services, whether public or private, make some payment and so are more used to paying for care than non-users of dental services.

The results also indicate a strong association between lagged and current use. Health status is controlled for, so this is not due to observed differences in health status. For any service use, NHS-only use is associated positively with use last year of either sector. Private use is negatively associated with use last year of NHS services but positively associated with lagged use of private services. Further, the estimated effect of past use of services in the same sector (the ‘same-sector’ effect) is substantially larger than the estimated effect of past use of services in the other sector (the ‘cross-sector’ effect). For example, the marginal effect of lagged use of NHS-only services on current use of NHS services is 0.3 while the effect of lagged use of NHS-only services on current use of the private sector is −0.015. The ‘same-’ and ‘cross-sector’ effects for lagged private care are 0.24 and 0.02, respectively.

The inpatient and dental estimates show rather different ‘same-’ and ‘cross-sector’ effects. For inpatient services, only lagged ‘same-sector’ use is associated with current use. The small size of the estimated marginal effect reflects the infrequency of use of inpatient services. In contrast, for dental services, the marginal effects of lagged use of both NHS and private care are positively associated with current NHS and current private sector use. This perhaps indicates that individuals move between public and private care when the cost difference between public and private treatment is not large and when dental insurance is not widely available (as during the period covered by these data).

But even for dental care the impact of lagged ‘own-sector’ use is considerably higher than that of lagged ‘cross-sector’ use. The estimated marginal impact of past NHS dental use on current NHS dental use is 0.36, while the marginal effect of past private dental use on current NHS use is only 0.105. Similar differences in the estimated marginal effects of lagged use can be seen for current private sector use. These results indicate that there is a tendency for individuals to re-use the sector they used last time.13

13 ‘Supplier-induced demand’, where NHS dentists encourage patients to ‘go private’ would suggest that the effect of lagged public use on current private use should be larger than the impact of lagged private use on current NHS use. The estimates here do not provide support for this idea.
These MNL estimates provide broad support for the model of Section 3. Those who value their health care more highly, as measured by education, use more services. Those with higher costs of waiting time (i.e., a higher $g_i$) — the employed and those with higher incomes — use more private services. If the parameter $\tau$ is interpreted more broadly as NHS quality, individuals with a higher $g_i$ — as measured by political attitudes — tend to be higher users of private services. There appears to be no direct impact of the measures of NHS quality used here. If past use is taken as a measure of (lower) search costs, those for whom the relative price of private services is lower tend to use more private services and those for whom the price of NHS services is lower tend to use more NHS services.

The importance of the lagged effects merits further exploration. The data permit the estimation of not only the effect of use of service $s$ at $t-1$ on service $s$ at $t$ but also of other services, denoted $s'$, at $t-1$ on use of service $s$ at $t$. Table 3 presents estimates of these marginal effects. The estimated model is the MNL model of Table 2 where lagged past service use is disaggregated into use of four specific services. These are dental care, eye care, inpatient stays, and a group of community-based services. Only the estimates of these lagged use variables are presented. The other coefficient estimates and marginal effects are very similar to those in Table 2.

The results show that use of a service in one sector is in almost all cases significantly associated with use of the same service a year later in the same sector. It is also often associated with use of the same service a year later in the other sector. But these latter ‘cross-sector’ effects are always smaller than the ‘own-sector’ effects. In other words, while individuals do change sector between years, they are more likely to use the same sector again next year rather than switch between sectors.

For inpatient services, there is a positive impact of lagged use in one sector on current use in the same sector. These ‘own-sector’ effects are generally significant but are small. There is little association between an inpatient stay and other service use which, given the low probability of an inpatient event, is not surprising. The ‘cross-sector’ effects are much smaller than for the other services and in most cases the coefficients from which the marginal effects are derived are not well defined. There is an interesting exception to this: the positive association between lagged private use of community services and current NHS inpatient use. This perhaps indicates a lack of availability of NHS community-based services.

The patterns of association with current dental service use also provide evidence of linked use within one sector over time. NHS dental use is associated with lagged use of both NHS dental and NHS eye services. Private dental service use is associated with lagged use of three of the four private services. The estimates also show the cross-sector association of use in dental services seen in Table 2: lagged private use is associated with current NHS use and lagged NHS use is associated with current private use.
The impact of past service use: multinomial logit estimates

<table>
<thead>
<tr>
<th></th>
<th>Any service use</th>
<th>Inpatient stay</th>
<th>Dental visit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NHS only</td>
<td>Private</td>
<td>NHS only</td>
</tr>
<tr>
<td></td>
<td>dp / dx (z-stat)</td>
<td>dp / dx (z-stat)</td>
<td>dp / dx (z-stat)</td>
</tr>
<tr>
<td>Public dental t−1</td>
<td>0.29 (43.8)</td>
<td>−0.002 (26.2)</td>
<td>−0.002 (0.4)</td>
</tr>
<tr>
<td>Private dental t−1</td>
<td>−0.03 (23.4)</td>
<td>0.26 (28.6)</td>
<td>−0.009 (1.1)</td>
</tr>
<tr>
<td>Public eye t−1</td>
<td>0.08 (10.7)</td>
<td>0.002 (6.7)</td>
<td>0.0007 (0.2)</td>
</tr>
<tr>
<td>Private eye t−1</td>
<td>−0.04 (3.8)</td>
<td>0.10 (11.1)</td>
<td>−0.007 (0.8)</td>
</tr>
<tr>
<td>Public inpatient stay t−1</td>
<td>0.05 (2.9)</td>
<td>−0.03 (0.2)</td>
<td>0.89 (18.1)</td>
</tr>
<tr>
<td>Private inpatient stay t−1</td>
<td>−0.10 (0.1)</td>
<td>0.12 (2.7)</td>
<td>0.003 (0.2)</td>
</tr>
<tr>
<td>Public other services t−1</td>
<td>0.11 (11.3)</td>
<td>0.01 (8.2)</td>
<td>0.014 (2.6)</td>
</tr>
<tr>
<td>Private other services t−1</td>
<td>−0.16 (3.1)</td>
<td>0.30 (15.5)</td>
<td>0.020 (2.4)</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>−17,091</td>
<td>−6692</td>
<td>−14,754</td>
</tr>
<tr>
<td>Sample size</td>
<td>20,586</td>
<td>20,569</td>
<td>20,519</td>
</tr>
</tbody>
</table>

(1) z-stats are for coefficient estimates and are calculated using robust standard errors. (2) Models estimated including all other parameters in Table 2.
5. Further investigation of dynamics

The results indicate a strong association between past and current use. If past use does determine present use, conditional on income and health status, this has important implications for the evolution of use of the private sector over time. So as the data is a panel, it is used to examine whether the impact of past use is robust to inclusion of individual effects.

To do this I focus on private use only. NHS and no use are combined into one category. For each of the 5 years of data and for each service, a binary indicator of whether the individual has used private health care is observed:

\[ n_{it}^* = I(n_{it}^* > 0) \]

where \( I(.) \) is the indicator function taking a value 1 if the expression in parentheses is true and 0 otherwise, \( n_{it}^* \) is the latent demand for private health care, \( i \) indexes the individual, \( t \) time, and \( s \) the service defined as above. This is a model with one error, where that error can be interpreted as the propensity to choose private care. The separate parameter estimates of the three alternative model cannot be recovered\(^{14}\) but, while the parameter estimates will not be the same as those of the multinomial logit model, the latent utility of private care will again be a function of all the parameters of the economic model. Using the data as a panel means individual effects can be allowed for, so the latent utility of private care is modelled as:

\[ n_{it}^* = \gamma_0 X_{it} + \gamma_1 Q_{it} + \gamma_2 n_{it-1}^* + \gamma_3 r + \gamma_4 T + v_i + \epsilon_{it} \]

(8)

where \( n_{it-1}^* \) is past private use of service \( s \), \( v_i \) is an individual effect, \( \epsilon_{it} \) is white noise, and all other variables are defined as above.

Eq. (8) is estimated as a random effects probit model. This allows for an individual specific effect, so is a richer error structure than the MNL model estimated above. Eq. (8) also includes the lagged dependent variable as a regressor. In a dynamic panel model where the number of time periods is short, correlation between the random effects term and the initial observation of the dependent variable (the so-called initial conditions problem) renders random effects ML estimation of the parameters of interest inconsistent if the initial conditions problem is ignored (Hsiao, 1986). To overcome this problem, a method

\(^{14}\) If the determinants of the indirect utility of the three options differed, it would be possible to recover the parameters of each of the three options from a binary outcome by estimating a model with partial observability. However, the economic model indicates that all variables affect all choices, so this is not possible without imposition of arbitrary exclusion restrictions.
suggested by Orme (1997) is used, an outline of which is given in the Appendix. The approach is to augment the model of interest with an estimated term that corrects for the correlation between the initial observation of the dependent variable \( n_{it} \) and the random error \( u_i \). Orme suggests that this will allow estimation of this correlation and, where this is not too high, the technique will yield adequate inferences for the parameters of interest.

To estimate the correction term requires that the variables that determine the initial observation of private demand are exogenous. To estimate the initial observation, I use parental socio-economic status, age and gender, using the argument that parental socio-economic status affects the initial level of private demand, but not subsequent changes. The estimates indicate that initial demand (the 1990/1 BHPS observation) is significantly associated with these variables.

Table 4 presents the random effects probit estimates with the correction term included. Estimates of the marginal effects are presented together with the \( z \)-statistics for the underlying coefficients from which the marginal effects are derived. The table indicates that the estimates of lagged use remain significant after correction for the initial condition problem. The coefficient on the correction term \( e_{it} \) indicates a positive correlation between \( n_{it} \) and \( u_i \) (the estimate varying from 0.25 for all private use to only 0.08 for inpatient use). The results without the Orme correction are not presented here but indicate a larger coefficient on the lagged term, so ignoring the initial conditions problem results in overestimation of the lagged effects. However, even with the correction term included, the estimated effects of lagged past private demand remain large in magnitude and highly significant for all three services.\(^{15}\)

The results in Table 4 show that the patterns of association identified in the MNL estimates are not simply due to individual heterogeneity. Conditional on random individual effects, private sector use remains significantly associated with employment status, education, income, health status, political attitudes and past use of the private sector. The lack of importance of waiting list and NHS availability measures remains. Private use at time \( t - 1 \) is a significant determinant of private use at \( t \). Although from a different stochastic structure, the results can be compared to the private use columns of the MNL model in Table 2. This comparison indicates close similarity of most of the estimates, though the random

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\(^{15}\) Two assessment of the goodness of fit of this model were made. The first was a comparison of the assumed parametric estimator (the random effects probit estimator) against a semi-parametric estimator (the loess estimator). This showed a close association between the two, suggesting robustness to the parametric assumptions. The second was a graphical test based on Klein (1993). The observations were grouped into 200 quantiles of the index function of the random effects probit estimator. The test statistic for the quantile, \( Q \), suggested by Klein, was plotted against the quantiles. The results showed little evidence of misspecification.
Table 4
The use of private health care services: random effects probit estimates with correction for initial conditions

<table>
<thead>
<tr>
<th></th>
<th>Any service use</th>
<th>Inpatient stay</th>
<th>Dental visit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( dp/dx ) ( (z\text{-stat}) )</td>
<td>( dp/dx ) ( (z\text{-stat}) )</td>
<td>( dp/dx ) ( (z\text{-stat}) )</td>
</tr>
<tr>
<td>Private use ( t = 1 )</td>
<td>0.20 (25.3)</td>
<td>0.059 (7.6)</td>
<td>0.37 (32.0)</td>
</tr>
<tr>
<td>( \epsilon_0 )</td>
<td>0.25 (15.7)</td>
<td>0.086 (3.1)</td>
<td>0.18 (11.5)</td>
</tr>
<tr>
<td>Social renter</td>
<td>-0.08 (8.3)</td>
<td>-0.0042 (2.6)</td>
<td>-0.048 (7.0)</td>
</tr>
<tr>
<td>Demographics (age, household composition)</td>
<td>Included</td>
<td>Included</td>
<td>Included</td>
</tr>
<tr>
<td>Self employed</td>
<td>0.07 (4.3)</td>
<td>-0.00075 (0.5)</td>
<td>0.040 (4.5)</td>
</tr>
<tr>
<td>Employed</td>
<td>0.05 (4.4)</td>
<td>-0.0017 (1.5)</td>
<td>0.024 (4.5)</td>
</tr>
<tr>
<td>Household income</td>
<td>0.0007 (8.6)</td>
<td>0.00005 (4.0)</td>
<td>0.00003 (6.6)</td>
</tr>
<tr>
<td>Household income sq</td>
<td>-0.7e-07 (4.4)</td>
<td>-3.8e-08 (1.9)</td>
<td>-3.0e-07 (3.3)</td>
</tr>
<tr>
<td>Industry dummies, public sector employee</td>
<td>Included</td>
<td>Included</td>
<td>Included</td>
</tr>
<tr>
<td>Health limits daily activity, health limits work, smoker, number of cigarettes smoked</td>
<td>Included</td>
<td>Included</td>
<td>Included</td>
</tr>
<tr>
<td>% RHA residents waiting &gt; 1 year</td>
<td>-32.0 (1.2)</td>
<td>-2.26 (0.9)</td>
<td>-</td>
</tr>
<tr>
<td>% RHA residents waiting &lt; 1 year</td>
<td>3.4 (1.97)</td>
<td>0.12 (1.3)</td>
<td>-</td>
</tr>
<tr>
<td>Dental availability</td>
<td>-</td>
<td>-</td>
<td>-0.00001 (0.3)</td>
</tr>
<tr>
<td>Conservative party supporter</td>
<td>0.04 (5.5)</td>
<td>0.0014 (1.4)</td>
<td>0.020 (5.0)</td>
</tr>
<tr>
<td>Disagree w/ 'All health care should be free'</td>
<td>0.013 (4.1)</td>
<td>0.0003 (0.7)</td>
<td>0.0087 (4.1)</td>
</tr>
<tr>
<td>Disagree w/ 'Unfair money buys priority'</td>
<td>0.0019 (1.0)</td>
<td>0.0011 (2.9)</td>
<td>0.0019 (1.0)</td>
</tr>
<tr>
<td>Regional effects</td>
<td>Included</td>
<td>Included</td>
<td>Included</td>
</tr>
<tr>
<td>Time effects</td>
<td>Included</td>
<td>Included</td>
<td>Included</td>
</tr>
<tr>
<td>Individual effects</td>
<td>Included</td>
<td>Included</td>
<td>Included</td>
</tr>
<tr>
<td>Sample size</td>
<td>7004</td>
<td>7002</td>
<td>6947</td>
</tr>
<tr>
<td>Mean probability of private use</td>
<td>0.23</td>
<td>0.009</td>
<td>0.12</td>
</tr>
<tr>
<td>Predicted probability (at means)</td>
<td>0.20</td>
<td>0.005</td>
<td>0.08</td>
</tr>
</tbody>
</table>

(1) \( dp/dx \) is the probability of using private care. Derived for continuous variable by estimation of the partial derivative at means of all variables. For dummy variables calculated as difference in evaluated probabilities when dummy \( = 1 \) and dummy \( = 0 \) at means of all other variables. (2) \( z \)-stats for coefficients are calculated using robust standard errors.
effects probit model gives higher estimates of the marginal effect of past private use on current private use for both dental and inpatient services.  

6. Discussion and conclusions

Lack of available data has limited the statistical analysis of the determinants of the choice between public and private health care in the UK. Previous studies have looked only at private health insurance or used aggregate data. This study estimates a competing risks model of the health care alternatives open to a user of care in the UK using individual data. It is also the first study to examine the impact of past use using microdata. Use of private health care is found to be strongly determined by income, demographics, attitudes to the equity goals of the NHS, political allegiance, and past use. Users of private services are richer, more likely to support the political right, less supportive of the equity goals of the NHS and more likely to have used private care in the past than the rest of the population. A separate and significant contribution of each of these factors is identified.

There is strong evidence of association between past and present use of private health care, and between past and present use of NHS care. The past private use of one health service is positively associated with current private demand for another and the past use of an NHS service is positively associated with current use of another NHS service. There is also a cross-sectoral flow. Past use of the NHS is positively associated with present use of private services. The flow is not just one way out of the NHS. The past use of services in the private sector is positively associated with current public sector use. The estimated positive impact of past private use on current NHS use of dental services is larger than the estimated impact of past NHS use on current private use.

While these findings support the idea that the users of private services are an identifiable social group and so (if examined cross-sectionally) could be argued to constitute a ‘private welfare class’, when a longitudinal analysis is undertaken, the support for a private welfare class is less strong. The analysis does not support the idea that there is a group of users in the UK who move into the private sector and stay there. Instead, there is considerable movement between the public and the private sectors. Taking all the private services for which there is an NHS alternative together, public and private use appear complementary. For dental care, private and public care also appear to be complements. Only for inpatient stays, which individuals require infrequently and for which they may buy insurance, does there appear to be a group that predominantly uses the private sector. Even this

16 The similarity with the MNL results perhaps indicates that the imposed assumption of uncorrelated errors in the MNL model does not seriously distort the results.
group is unlikely to use only private care, as several inpatient services (e.g. accident and emergency services) are not provided privately. Nor does support for the equity goal of the NHS appear to be linked most strongly to sector in which health care has been taken. Support for the equity goals of the NHS is strongest amongst non-users, and public and private users are closer to each other than to non-users.17

The results suggest that despite the recent growth in the use of private financed health care, there is perhaps not a distinct group of private service users who have completely opted out of the NHS. Instead, the use of private services appears to be complementary to the use of the public sector. Those who use one sector use the other, and those who use the private sector retain considerable support for the NHS. Such patterns have implications for the growth of private and public care in the UK.

Acknowledgements

I am grateful to the Data Archive for access to the British Household Panel Survey and to the Joseph Rowntree Foundation for funding. Tania Burchardt provided excellent data assistance and comments. Two anonymous referees helped to produce a much improved paper. My thanks are also due to Simon Burgess and seminar participants at the Universities of Bristol, Manchester, Essex and the LSE. All remaining errors are mine.

Appendix A

The model of interest takes the following form:

\[ n_{it}^* = \gamma n_{i,t-1} + \beta' x_{it} + v_i + \epsilon_{it}, \quad i = 1, \ldots, N, t = 1, \ldots, T \]  

(A.1)

where \( n_{it}^* \) is the latent use of private health care, \( x_{it} \) is a vector of individual characteristics, and \( v_i \) an unobserved individual effect. The ‘initial conditions’ problem occurs where the initial observation, \( n_{i0} \), is correlated with the random error term \( \epsilon_{i0} \). To allow for this problem, Heckman (1981) can be followed and a reduced form equation is specified for the initial observation:

\[ n_{i0} = x' z_i + \eta_i \]  

(A.2)

where \( z_i \) is a vector of strictly exogenous instruments, \( \text{var}(\eta_i) = \sigma^2 \eta \) and \( \text{corr}(\epsilon_i, \eta_i) \).

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17 See also Burchardt et al. (1999).
\[ \eta_i = \rho \). The next step involves a linear specification, in terms of orthogonal error components, to account for the possibility of non-zero \( \rho \):
\[
\eta_i = \theta v_i + e_{i0}
\]

It is assumed the initial observation \( n_{i0} \) is uncorrelated with \( e_{it} \), and also that \( e_{i0} \) is uncorrelated with the \( x_{it} \) for all \( i \) and \( t \). This model can be estimated but requires that special software is written. Orme (1997) suggests a two-step method of estimation, in the spirit of Heckman’s standard sample selection correction method, which is an approximation in the case of small values of \( \rho \). To account for the correlation between the initial condition and the unobserved heterogeneity \( v_i \), a correction term is added to the model of interest. This can then be estimated using standard software for estimation of random effects probit models.

The first step of Orme’s two-step procedure involves probit estimation of Eq. (A.2) to generate this correction term, \( e_{i0} \), where
\[
e_{i0} = (2n_{i0} - 1) \Phi(\hat{x} z_i) / \Phi(2n_{i0} - 1 \hat{x} z_i)
\]
and \( \hat{x} \) is the MLE from the probit reduced form model. The second step involves random effects probit estimation of Eq. (A.1) augmented with the correction term
\[
n_{i1} = \alpha + \beta' x_{it} + \delta e_{i0} + v_i + e_{it}, \quad i = 1, \ldots, N, t = 1, \ldots, T.
\]

The new error term that enters the random effects probit estimation is heteroskedastic. But Orme (1997) shows that, from Monte-Carlo results, it is not necessary to worry about this heteroskedasticity, producing inconsistent parameter estimates in the case of small values of \( \rho \).

References


