The Demand for Private Health Care in the UK[1]

Carol Propper
Department of Economics University of Bristol
8 Woodland Road Bristol BS8 1TN

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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.

1 Introduction

Health care in the UK is predominately state financed. But while approximately 85 percent 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, opthalmic 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 lead 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 (mostly by political scientists) 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* (1996) show a link between medical insurance purchase and quality of NHS services. But 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 potential users of care in the UK have between private care, NHS care, 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 which 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

[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 maintaing public funding of these services.

example, Culter and Gruber 1996a, 1996b)), 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* (1996) 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 is NHS use 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 between 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 presented. 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 percent of total health care expenditure in 1979 to 15 percent 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 copayment 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[2]. Dental services are of interest because although all individuals are entitled to NHS dental care, it is argued the availability of such care is being reduced by suppliers without the approval of the Department of Health.

Table 1 shows the patterns in private demand for the different services for each of the first five years of the survey. Approximately 16 percent 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

[2]Private medical insurance primarily covers in- and out-patient hospital services.

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 τ. At its simplest this can be waiting time, but more generally can be thought of 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 τ 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 monetary cost, but the individual has to access NHS facilities. Let this cost be c_i (relative to income).

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

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

is indifferent between private care and no care when

$$V_i = p_i \tag{2}$$

and is indifferent between NHS care and no care when

$$V_i \exp(-g_i\tau) = c_i \tag{3}$$

Equations (1), (2) and (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 τ 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 demander 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 τ is the waiting time for NHS treatment, g_i is the individual's discount rate, or alternatively, their valuation of time. We can expect this 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[3]. More generally, where g_i is the valuation of NHS quality, we might expect this valuation to reflect individual's general attitudes to the 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 τ.

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 the greater the 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 equations (1) to (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 jth choice can be written as:

$$m^*_{ji} = \beta'_j z_i + e_{ji} \tag{4}$$

[3]For an empirical estimate of the value of time in a medical context see Propper (1995).

where the z_i 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].

If the individual is observed making choice j we assume that m^*_{ji} has the highest net valuation. The statistical model is driven by the probability that choice j is made, which is

$$\Pr(m^*_{ji} > m^*_{ki}) \text{ for all } k \neq j$$

If the ϵ_{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:

$$\Pr(m_i = j) = e^{\beta'_j z_i} / \sum_{k=1}^{J} e^{\beta'_j z_i} \tag{5}$$

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 our estimation of this model we impose the restriction that $\beta_1 = 0$.

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, we allow for regional effects. So the latent net valuation of alternative j will depend on:

$$m^*_{ji} = f(X_i, Q_r, m_{jit-1}, R; e_{ji}) \quad j = 1, 2, 3 \tag{6}$$

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_r is 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_{jit-1} is use of alternative j last period, and e_{ji} is white noise error.

In fact, we observe use at 5 time points and of several health services, denoted s (these are defined below). So the data permit examination of past use of one service on another, and of past use of one alternative on another. So in estimation, the set of variables in (6) are expanded to include these

[4]This model is of the form of the model of occupational choice of Schmidt and Strauss (1975).

'cross-service' effects and 'cross-alternative' effects. We also allow for time effects. So the latent utility for alternative j of service s is:

$$m_{jit}^{s*} = \beta_0 X_{it} + \beta_1 Q_{rt} + \beta_2 m_{jit-1} + \beta_3 m_{j'it-1} + \beta_4 R + \beta_5 T + e_{jit}, \quad j = 1, 2, 3 \quad (7)$$

where m_{jit-1} and $m_{j'it-1}$ are now vectors of past service use, j' indexes the other alternatives, T is a vector of time dummies, and e_{jit} is white noise error[5]. From (5) the parameter estimates will differ across the two alternatives but for simplicity of notation we have dropped the subscripts on these. As we impose the restriction that the parameter estimates are 0 for alternative 1 (no care) we only estimate the parameters for alternatives 2 and 3.

3.3 The data

From the BHPS data we define the use of three services or set 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

[5]The MNL model imposes the assumption of independence of the errors across options. While this is an unattractive feature of the 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 their 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.

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* 1996), or rather more limited measures (Propper 1993). By using BHPS data we are able to control for a large number of measures of health status. In addition, by conditioning on health status, we are able to reduce the potential contamination of the income coefficient which arises from the correlation between health and income. To these data we match regional indicators of the quality of the NHS. These are the length of NHS waiting lists over 12 months and under 12 months deflated by the regional population (relevant for inpatient care), and an index of dental service availability for dental care[8]. We do not observe the prices paid by individuals in our data so do not examine the impact of price[9]. As price at point of use for hospital inpatient services will depend on insurance coverage, but the BHPS does not record private insurance cover, we include occupational dummies as instruments for corporate cover[10].

4 The determinants of private, NHS and no demand

We estimate a multinomial logit (MNL) model of the use of public and private care. 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_i on choice of alternative j[11]. The interpretation of the marginal effect is the impact of a unit change of the variable x_i 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

[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 average annual private insurance premia. 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 (1996) found that corporate health insurance cover varies by occupation.

[11]The estimated marginal effects are $\delta p_j/\delta x_i$. The relationship to the estimated β_j is $\delta p_j/\delta x = p_j(\beta_j - \sum p_j\beta_j)$ which depends on the estimated parameters for all the options.

have coefficients which 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 reflects the fact that the any service set includes preventative services. Educational attainment is positively associated with use of both sectors, though the magnitude of the estimated marginal effects is larger for the private alternative. Previous analyses of NHS use have 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. We investigate the endogeneity of these variables elsewhere (Burchardt and Propper forthcoming), and find 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[12]. We 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. But 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 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. We control for health status, 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 substantial 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 $-.015$. 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

[12]These and other results not presented here are available from the author.

'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 is perhaps indication that individuals move between public and private care when the cost difference between public and private treatment is not necessarily 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].

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 a 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 τ 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 means it is possible to estimate not only the effect of use of service s at $t-1$ on service s at t, but also to examine the use 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 4 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.

[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. These estimates do not support this idea.

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 change.

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 which is 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.

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, we use it to examine whether the impact of past use is robust to inclusion of individual effects.

To do this we focus on private use only. We combine NHS and no use into one category. For each of the 5 years of data and for each service, we observe a binary indicator of whether the individual has used private health care:

$$n_{it}^{s} = I(n_{it}^{s*} > 0)$$

where $I(.)$ is the indicator function taking value 1 if the expression in parentheses is true and 0 otherwise, n_{it}^{s*} is the latent demand for private health

care, i indexes the individual, t time, and s the service defined as above. We therefore estimate a model with one error, where that error can be interpreted as the propensity to choose private care. In terms of the latent indirect utilities of the model outlined above, we combine the error terms for alternatives 2 and 1[14]. We therefore cannot recover the separate parameter estimates of the 3 alternative model[15]. 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 the all the parameters of the economic model. In addition we can allow for individual effects, so the latent utility of private care is modelled as:

$$n_{it}^{s*} = \gamma_0 X_{it} + \gamma_1 Q_{rt} + \gamma_2 n_{it-1} + \gamma_3 R + \gamma_4 T + v_i + \varepsilon_{it} \tag{8}$$

where n_{it-1} is past private service use, v_i is an individual effect, ε_{it} is white noise, and all other variables are defined as above.

We estimate (8) as a random effects probit model, including 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 we use a method suggested by Orme (1997), an outline of which is given in the Appendix. The approach is to augment the model of interest with an estimated term which corrects for the correlation between the initial observation of the dependent variable (n_{i0}) and the random error (v_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 which determine the initial observation of private demand to be exogenous. To estimate the initial observation we 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.

[14] As the errors are independent they can be added.

[15] 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.

Table 4 presents the random effects probit estimates with the correction term included. Estimates of the marginal effects are presented together with the z-stats 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 conditions problem. The coefficient on the correction term (e_0) indicates a positive correlation between n^*_{i0} and v_i (the estimate varying from .25 for all private use to only .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[16].

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 $t-1$ is a significant determinant of private use at t. The results can be compared to the private sector use columns of the MNL model in Table 2. This comparison indicates a close similarity between most of the estimates, though the random effects probit model gives higher estimates of the marginal effect of past private use on current private use for both dental and inpatient services[17].

6 Discussion and Conclusions

Lack of available data has limited the statistical analysis of the determinants of the choice the individual in the UK has between NHS and private sector health care. Previous studies have looked only at private health insurance or

[16]Two assessment of the goodness of fit of this model were made. The first was a comparison of the assumed parametric estimator (the probit estimator) against a semi-parametric estimator (the lowess 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.

[17]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.

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. We find use of private health care 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. We identify a separate and significant contribution of each of these factors. For example, the impact of income remains once employment status is controlled for, and the impact of political belief remains once tenure and employment status, often argued to be determinants of voting intentions in the UK, are controlled for.

We also find 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. But 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. In fact, for dental services, the estimated positive impact of past private use on current NHS use 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 perhaps if looked at 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. Our analyses do 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 who predominantly uses the private sector. And even this group are unlikely to use only the private sector, as several inpatient services (e.g. accident and emergency services) are not provided in the private sector. Nor does support for the equity goals 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[18].

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.

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A Appendix

The model of interest takes the following form

$$y_{it}^{*} = \alpha y_{i,t-1} + \beta^{'} x_{it} + \sigma u_i + \varepsilon_{it}, i = 1, ..., N, t = 1, ..., T$$

where the initial observation is correlated with the random error term

$$y_{i0}^{*} = \lambda^{'} z_i + \eta_i, \ corr(u_i, \eta_i = \rho)$$

and we observe y_{i0}

$$y_{i0} = I(y_{i0}^{*} > 0)$$

where $I(.)$ is the indicator function which take value 1 if the statement is true. Orme (1997) suggests augmentation of the model of interest with the estimate of the parameter e_{i0}

$$y_{it}^{*} = \alpha y_{i,t-1} + \beta^{'} x_{it} + \delta e_{i0} + v_i + \varepsilon_{it}$$

where e_{i0} is

$$e_{i0} = (2y_{i0} - 1)\phi(\lambda^{'} z_i)/\Phi((2y_{i0} - 1)\lambda^{'} z_i)$$

and the z_i are strictly exogenous instruments.

Table 1*:* Proportion of sample using private health services in British Household Panel 1990-95

Proportion	1990/1	1991/2	1992/3	1993/4	1994/5
Private dental care	9.0	8.5	1.1	11.6	12.7
Private eye care	8.6	8.4	10.5	10.0	10.7
Private physiotherapy, chiropody or health visitor	4.0	4.2	4.9	5.2	5.0
Private inpatient stay	1.0	0.9	0.8	0.9	0.9
Any private health service use	18.4	17.5	20.9	21.3	22.4
Base (weighted)	9911	9458	9021	9054	8816

Table 2. Multinomial logit estimates of marginal effects of NHS and private use

	Any service use		Inpatient stay		Dental Visit	
	NHS only dp/dx (z stat)	Private dp/dx (z stat)	NHS only dp/dx (z stat)	Private dp/dx (z stat)	NHS only Dp/dx (z stat)	Private dp/dx (z stat)
Gender	.05	.002	.024	.001	.03	-.005
	(8.0)	(5.0)	(5.6)	(0.9)	(4.9)	(0.9)
Social renter	.020	-.09	.0004	-.0010	-.021	-.060
	(5.5)	(10.3)	(0.1)	(2.8)	(7.2)	(8.7)
Higher education	.005	.02	-.005	-.0013	.012	.0084
	(3.0)	(4.6)	(1.0)	(0.9)	(2.6)	(2.8)
Age, Age^2, Family composition	Yes	Yes	Yes	Yes	Yes	Yes
Self employed	-.12	.07	-.06	.0009	-.063	.031
	(5.1)	(1.1)	(5.8)	(0.1)	(3.5)	(1.6)
Employed	-.09	.05	-.06	-.003	-.05	.025
	(4.8)	(1.5)	(9.5)	(1.5)	(3.9)	(1.7)
Public sector	.014	-.01	.004	.026	.0078	-.0069
	(0.5)	(0.4)	(3.6)	(0.7)	(0.4)	(0.7)
Household income	-.0003	.0006	.0001	.0008	-.0001	.00028
	(2.3)	(9.2)	(3.0)	(6.4)	(2.9)	(7.4)
H'hold income squared	2.66e-07	-4.18e-06	-1.56e-07	-5.75e-08	6.1e-08	-1.85e-07
	(0.3)	(4.5)	(2.1)	(3.8)	(0.7)	(3.6)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Health limits daily activity	-.002	-.02	-.03	-.003	.012	-.023
	(1.5)	(2.4)	(6.0)	(4.0)	(0.2)	(2.3)
Health limits work	-.02	.001	-.03	.0005	.026	.012
	(1.5)	(0.8)	(4.8)	(0.6)	(2.0)	(2.0)
Smoker	.01	.01	-.009	-.0004	.03	.002
	(1.8)	(1.8)	(1.3)	(0.4)	(1.8)	(0.8)
Number of cigarettes	-.002	-.0004	-.0007	-.00006	-.003	-.0003
	(3.1)	(2.2)	(2.0)	(1.0)	(3.1)	(1.6)
Other health controls	Yes	Yes	Yes	Yes	Yes	Yes
Conservative party supporter	-.01	.04	.00003	.0017	-.0004	.020
	(2.1)	(5.6)	(0.0)	(1.1)	(1.8)	(4.8)
Disagree w/ 'All health care	-.001	.01	-.0015	.0003	.00033	.010
should be free'	(2.5)	(4.7)	(0.7)	(0.3)	(2.2)	(5.2)
Disagree w/ 'Unfair money buys	-.004	.005	.0008	.0017	-.002	.0013
priority'	(0.3)	(1.2)	(0.5)	(2.8)	(0.5)	(0.4)
Public use *t-1*	.30	-.015	.09	-.002	.36	.012
	(43.3)	(21.8)	(20.1)	(0.3)	(65.0)	(25.3)
Private use *t-1*	.02	.24	.004	.026	.105	.19
	(20.3)	(36.4)	(0.3)	(13.6)	(21.1)	(42.1)
% RHA resid waiting > 1 year	Yes (ns)	Yes (ns)	Yes(ns)	Yes (ns)	-	-
% RHA resid waiting < 1 year	Yes (ns)	Yes (ns)	Yes (ns)	Yes (ns)	-	-
Dental availability	-	-	-	-	Yes (ns)	Yes (ns)
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	-17960		-6630		-14844	
Sample Size	21002		20962		20598	

Notes

1. z stats are for coefficient estimates and are calculated using robust standard errors
2. Health controls are dummy variables for whether individual has health problems with or suffers from following conditions: limbs, sight, hearing, skin, chest, heart/blood pressure, stomach/digestion, diabetes, anxiety/depression, alcohol/drugs, epilepsy, and other conditions excluding the above.
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.

Table 3. The impact of past service use: multinomial logit estimates

	Any service use		Inpatient stay		Dental visit	
	NHS only dp/dx (z stat)	Private dp/dx (z stat)	NHS only dp/dx (z stat)	Private dp/dx (z stat)	NHS only dp/dx (z stat)	Private dp/dx (z stat)
Public dental *t-1*	.29	-.002	-.002	.005	.36	.013
	(43.8)	(26.2)	(0.4)	(2.8)	(63.8)	(25.1)
Private dental *t-1*	-.03	.26	-.009	.005	.10	.19
	(23.4)	(28.6)	(1.1)	(2.2)	(20.8)	(40.8)
Public eye *t-1*	.08	.002	.0007	.002	.03	-.01
	(10.7)	(6.7)	(0.2)	(1.1)	(3.7)	(0.4)
Private eye *t-1*	-.04	.10	-.007	.006	.004	.023
	(3.8)	(11.1)	(0.8)	(3.6)	(1.9)	(4.5)
Public inpatient stay *t-1*	.05	-.03	0.89	-.001	.009	-.006
	(2.9)	(0.2)	(18.1)	(0.2)	(0.5)	(0.5)
Private inpatient stay *t-1*	-.10	.12	.003	.023	.017	.016
	(0.1)	(2.7)	(0.2)	(12.2)	(0.9)	(1.2)
Public other services *t-1*	.11	.01	.014	.0003	.002	-.001
	(11.3)	(8.2)	(2.6)	(0.2)	(0.2)	(0.05)
Private other services *t-1*	-.16	.30	.020	.007	.009	.023
	(3.1)	(15.5)	(2.4)	(4.0)	(1.7)	(3.3)
Log likelihood	-17091		-6692		-14754	
Sample Size	20586		20569		20519	

Notes

1. z-stats are for coefficient estimates and are calculated using robust standard errors
2. Models estimated including all other parameters in Table 2.

Table 4: The use of private health care services: random effects probit estimates with correction for initial conditions

	Any service use dP/dx (z stat)	Inpatient stay dP/dx (z stat)	Dental visit dP/dx (z stat)
Private use t-1	.20	.059	.37
	(25.3)	(7.6)	(32.0)
E_0	.25	.086	.18
	(15.7)	(3.1)	(11.5)
Social renter	-.08	-.0042	-.048
	(8.3)	(2.6)	(7.0)
Demographics (age, household composition)	Included	Included	Included
Self employed	.07	-.00075	.040
	(4.3)	(0.5)	(4.5)
Employed	.05	-.0017	.024
	(4.4)	(1.5)	(4.5)
Household income	.0007	.00005	.0003
	(8.6)	(4.0)	(6.6)
H'hold income sq.	-4.7e-07	-3.8e-08	-3.0e-07
	(4.4)	(1.9)	(3.3)
Industry dummies, public sector employee	Included	Included	Included
Health limits daily activity, health limits work, smoker, number of cigarettes smoked	Included	Included	Included
% RHA residents waiting > 1 year	-32.0	-2.26	-
	(1.2)	(0.9)	
% RHA residents waiting < 1 year	3.4	.12	-
	(1.97)	(1.3)	
Dental availability	-	-	-.00001
			(0.3)
Conservative party supporter	.04	.0014	.020
	(5.5)	(1.4)	(5.0)
Disagree w/ 'All health care should be free'	.013	.0003	.0087
	(4.1)	(0.7)	(4.1)
Disagree w/ 'Unfair money buys priority'	.005	.0011	.0019
	(1.8)	(2.9)	(1.0)
Regional effects	Included	Included	Included
Time effects	Included (ns)	Included (ns)	Included (ns)
Individual effects	Included	Included	Included
Sample Size	7004	7002	6947
Mean probability of private use	.23	.009	.12
Predicted probability (at means)	.20	.005	.08

Notes

1. dP/dx is probability of using private care. Derived for continuous variable calculated by estimation of the partial derivative at means of all variables. dP/dxs 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 derived using robust standard errors