THE DEMAND FOR AND USE OF PRIVATE HEALTH INSURANCE IN THE UK AND THE COSTS OF NHS WAITING LISTS

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CONTENTS

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ABSTRACT

This thesis examines three aspects of consumer behaviour in the British health care market. The UK health care market is a mixed public-private system, in which the private sector provides only a limited alternative to public provision. Within this market, the research examines the non-corporate demand for private health insurance, the demand for private health care by the insured and the costs to consumers of allocation of non-urgent care in the NHS by means of waiting list. An analytical model of demand for health insurance which explicitly incorporates the limited natures of both the private sector and the market for health insurance is developed. This model is investigated by means of computer simulation and tested by econometric estimation, using the 1982 General Household Survey as the data base. A model of the utilisation of health insurance which also takes into account the limited nature of the private sector is developed. This model is tested by means of econometric estimation. The costs for consumers of medical care of waiting lists is the disutility of time spent waiting for care. The research seeks to estimate a monetary value of this disutility. We investigate the nature of the costs of waiting lists for non-urgent medical care and examine an economic framework for estimation of the value of these costs. An econometric model is proposed and is estimated using data collected

specifically for the research. The data records the stated intentions of respondents to trade-off money against time to obtain non-urgent medical treatment and was collected using 'Stated Preference' methodology.

CHAPTER 1

INTRODUCTION

The concern of this thesis is the behaviour of the consumer in a health care market in which a private sector provides a limited set of substitutes for publicly provided and financed health care. Specifically, the research addresses two related issues in the British health care market: the first, the demand for and utilisation of private health insurance in the UK and the second, the costs to the consumer of the allocation of health care in the public sector by waiting list.

The economics of health insurance has been examined in some depth in health care systems in which the main source of finance for health care is the private agent (e.g. Arrow 1963; Phelps 1976; Keeler et al 1977; Ehrlich and Becker 1972; Nordquist and Wu 1976). In the UK the extension of private health insurance cover is a recurrent theme in the periodic debates on the 'future of the National Health Service' (Maynard 1982; Culyer et al. 1988). Yet surprisingly little research effort has been spent on positive economic analysis of the UK private health insurance market. The present work seeks to begin this analysis. We focuses on the behaviour of the demander, taking the supply side as given, as to study both the demand and supply sides of the market would be

beyond the scope of the present work. We investigate both the non-corporate demand for health insurance and the demand for private health care of the privately insured.

The existence of a private sector and a private health insurance market alongside the NHS must depend on the existence of unmet consumer demand for certain types of health care or consumer dissatisfaction with the care provided in the state sector. One of the reasons that has been cited for the demand for private sector medical care in the UK is the existence of waiting lists in the NHS (Gillam 1985). The study of the costs of NHS allocation of non-urgent medical care by waiting list is therefore a complement to and an extension of our examination of private health insurance.

An understanding of the current UK health care market is the starting point for all the research presented in this thesis. In this introductory chapter we outline those features which we view as central to the research. The chapter is divided into three sections. In the first, we present a brief outline of the nature of the British health care market and examine the nature and delivery of medical care in the National Health Service (NHS), concentrating upon the hospital based sector, and then move to examine the independent (private) hospital sector. In the second, we examine one particular feature of the UK health care market in more detail; the use of queues and waiting lists to allocate certain types of care in the NHS. In the final section we outline of the

organisation of the rest of the work.

1. THE UK HEALTH CARE SYSTEM

1.1 The Public Sector

Public sector contribution to both the finance and the delivery of health care in the UK is high by international standards. On the finance side, the public sector share of all health care expenditure and of medical care benefits is about 84 and 92 percent respectively (Poullier 1986). This finance is raised through central government general taxation, from which individuals cannot 'contract out'. The delivery of care is dominated by the NHS, which was established in 1948 through the nationalization of the hospital stock and the provision of primary and specialist care at zero money cost at point of demand. The much quoted objective was to ensure access to medical care on the basis of need rather than ability to pay. Despite the introduction and increased use of user charges, allocation of medical care by the price mechanism remains very limited in the NHS. Most care is still supplied at zero price at point of demand. The quantity and quality of the medical care delivered is determined to a large extent by the supplier of care. This supplier perhaps acts as a perfect agent for the demander or perhaps also act as his/her own agent. However, all actions are subject to the constraints of global and local

NHS budgets.

Lindsay (1980) has argued that provision of a good by a not-for-profit supplier results in an output with different attributes from that which would be provided by a supplier whose aim was to maximise profit. He argues that in a bureaucracy which provides a service at zero price, performance cannot be assessed by means of profit. Other methods of assessment must be sought, and information must be collected by the organisation for the express purpose of monitoring output and performance. Such collection has a cost. Moreover, it is more costly to collect certain data than others. Lindsay argues that the relative costs of data collection lead to an overemphasis of the importance of easily measured attributes of the good and to an underemphasis of the importance of more intangible attributes. In response to these differences in data collection costs, bureaucratic managers/suppliers alter the nature of the output. In equilibrium, the output produced has fewer intangible attributes than that which would be produced by a private sector supplier. Lindsay argues that in the NHS the outcome of this process is the undersupply of 'consumer-orientated' attributes of care, such as information, reassurance and hotel type facilities, and the oversupply more easily measured items, such as bed-days per treatment.

The (fairly scanty) evidence does not wholly support Lindsay's thesis. Comparison of the output of

American hospitals with that of the NHS does indicate that consumer orientated attributes of care are provided to a higher degree in the American hospitals. But to compare two different systems in this way is to implicitly assume that all factors which may affect output, other than the bureaucratic nature of the organisation, do not differ between the two health care systems. In comparing American for-profit hospitals with NHS hospitals this assumption is clearly not met. In the UK, the providers of private hospital care stress the provision of information and hotel facilities in the private sector (BUPA 1988) and it seems likely these are greater in the private than the public sector. But the sole study which compared length of stay in private sector and NHS hospitals (Williams et al. 1985a) found that lengths of stay for those procedures which are routinely performed in the private sector were longer in the private than in the public sector. These findings suggest that factors other than the degree of bureaucracy could be determinants of the attributes of medical care. For example, recent work in the North American market suggests the method of payment is important in determining output. It is argued, for example, that the introduction of Preferred Provider Organizations, which do not change the structure of provision, but alter the method of payment for care, will change the output from that supplied by providers reimbursed by third party insurance (Culyer et al. 1988). In the UK context, Maynard (1988) has argued that the

length of stay in the UK private sector is due, not to the presence or absence of bureaucratic structures or priced output, but to the use of third party reimbursement methods of insurance. However, while the nature of NHS output may or may not be due to bureaucratic organisation, qualitative evidence, such as the current concern with consumerism in the NHS, does suggest that the NHS is viewed as providing fewer consumer orientated attributes than that desired by some potential consumers. But perhaps the main source of concern or discontent is not the type of care provided in the NHS, but the wait associated with receipt of this care.

In any market in which separation of the payment for and the receipt of the good occurs, excess demand is likely to arise (Barr 1987). In the absence of a money price in the NHS, health care provision must be rationed between demanders if the global ceiling on expenditure is not to be exceeded. Rationing takes several forms. It may be explicit (e.g. RAWP) or may be implicit, it may take effect through restrictions on the quantity or reductions in the quality of the care provided. The most obvious form of rationing in the NHS is the use of queues as a mechanism for allocation of care. We return to an analysis of the effect of allocation by queue below, but before this we turn to an examination of the key features of the private sector in the UK health care system.

1.2 The Private Sector

In terms of total expenditure the private sector in the UK is dwarfed by the NHS. Gross expenditure on acute health care provided in the private sector has been estimated at 700 to 750 million pounds in 1987, while the NHS budget in that year was approximately 20 billion pounds (Maynard 1988). However, this absolute size comparison masks the contribution of the private sector to the provision of specific types of care. The private sector has traditionally concentrated upon the provision of facilities for acute non-emergency, mainly surgical care (sometimes referred to as 'cold surgery'). Williams et al (1985b) estimated that private sector activity accounted for approximately 13 per cent of all domestic inpatient surgery in 1981, this proportion rising to 26 percent of certain types of surgery and 20 percent of all surgery in London and the South East. In the 1980s there has been some expansion in the private sector out of the traditional areas of cold surgery into more complex surgery and specialisms such as treatment for infertility. However, to date this expansion has been relatively minor, and in 1987 fewer than 20 types of common surgical procedure accounted for about 70 percent of private sector expenditure on acute care (Maynard 1988).

In the 1980s the private sector has also moved into the provision of private nursing home care for the

elderly and handicapped. However, as such care is explicitly excluded from the cover provided by private health insurance contracts, we exclude this type of private sector provision from any of our discussion and analysis.

The small size of the public sector perhaps also masks the extent of the interaction between the two sectors. To a large extent, the activities of the private sector are determined by those of the NHS. On the demand side, the gap between the type of care demanded and the nature of the care provided in the public sector creates a demand for private sector care. The private acute health care providers have not sought to replicate NHS provision on a smaller scale, but provide facilities for treatment for a more limited set of states of ill-health. The private sector has concentrated its efforts upon those services for which there is explicit, in the form of waiting lists, or implicit, in the form of provision of care with fewer 'consumer-orientated' attributes, rationing in NHS care.

On the supply side, the labour employed in the private sector is either concurrently employed in the public sector (consultants and perhaps some nursing staff) or is generally trained in the public sector. NHS contracts have permitted consultants to undertake private practice alongside their NHS work, initially largely within NHS facilities (NHS paybeds), but more recently mostly in independent private sector facilities. Maynard

(1982) has argued that changes in NHS policy have encouraged the growth of the independent private sector. He singled out two policies as of particular importance; the first, the attempt to phase out NHS pay beds in 1976 (the 1976 Health Services Act) and the second, the introduction of new contractual arrangements for NHS consultants in 1981. Maynard argues the effect of the first was to stimulate the construction of private sector hospitals. The effect of the second was to increase the potential supply of consultant labour to the private sector. Specialists in the NHS have been permitted since 1948 to work in the private sector, thus many consultants have worked concurrently in both sectors. The 1981 changes permitted NHS consultants to undertake more private sector work whilst remaining employed by the NHS, but simultaneously reduced the incentives for full-time NHS work.

Demand for private sector care is not only a function of a desire for care with different attributes, but also of ability to pay. The importance of income is reflected in the geographical distribution of private sector facilities. Approximately 30 percent of private sector care in 1981 was provided in NHS pay beds. The remainder was provided in private facilities, over 50 percent of which are located in the South East of England (Association of Independent Hospitals 1985). Over half the beds in these hospitals are owned by for-profit suppliers, the rest provided by charitable entities

(referred to as 'not-for-profit' in the health literature). Medical care in these hospitals can either be self-financed (sometimes referred to as self-insurance) or funded through the purchase of reimbursement medical insurance. Data for 1981 (Williams et al 1985b) indicated that approximately 30 percent of private care was self financed (primarily abortions) but Maynard (1988) estimated that this had fallen to 10 percent by 1988.

It is clear that several factors account for the precise nature of the interdependence between the public and private sectors in the UK. Further, there are a number of differences in the good provided in, and the allocation mechanisms of, the two health care sectors. In this work we take into account these differences, but we focus particular attention on the consequences of allocation by time in one sector and money in the other. The thesis examines three features of the UK health care market which are the result, wholly or in part, of this difference in allocation mechanisms. The first is the demand for private health insurance. The second is the utilisation of private sector care by those covered by health insurance. The third is the costs to consumers of allocation of non-urgent medical care in the NHS by waiting list. An understanding of the role of time in the allocation of health care in the UK is necessary for the analysis of any of these three topics. In the next section, we outline the role played by time in the allocation of health care generally, and in the NHS in

particular. As our interest is primarily in the behaviour of the consumer, we focus on the impact of allocation by time on the demander, rather than the supplier, of care.

2. THE ROLE OF TIME IN THE ALLOCATION OF MEDICAL CARE

Becker (1965) argued that utility from market goods can only be derived if the consumer inputs time into their consumption. Further, as time is a scarce resource, this use of time has a cost. This implies that consumption has both a time and a money price. Acton (1976) proposed a model of the demand for medical care which incorporated Becker's analytical insights. In the Acton model the consumer maximizes utility, derived from the consumption of medical care and all other goods, subject to a budget constraint which incorporates both income and time constraints. Acton (implicitly) assumes a single unit of time can only be used in one consumption activity, and thus, in his model, the consumption of medical care has both a time and a money cost. The comparative static results indicate that the elasticity of demand for medical care with respect to time depends on both the time and the money price. The absolute value of this elasticity is a positive function of the size of the time price relative to the sum of the time and money prices of care. The implication of these results is that time price will be more important to demand in health care systems in which care is primarily allocated by means of time, and money

price more important in health care systems in which the money cost is a large component of the price. Empirical studies by Acton (1976) and Phelps and Newhouse (1974) have given some support to these hypotheses. Later research on the effect of time has distinguished between different aspects of the demand for medical care. Coffey (1983), for example, found that travel and waiting time were significant correlates of the choice of the supplier of medical care, but not of the frequency of use of that supplier.

Research has also been undertaken into the function of time as a rationing device (see Iversen (1986) for a review). In this context, it is helpful to distinguish between the queue and the waiting list. The former involves waiting in person, the latter does not. Both are used widely in the NHS. Access to primary care and hospital outpatient care is generally by means of both queue and waiting list, some GPs and some hospital outpatient departments making greater use of queues than others. Access to inpatient surgical speciality (once referred by the GP) is primarily by waiting list.

Time spent queuing in person has an opportunity cost equal to the next best alternative use of the time. If the utility of medical care received is affected by the amount of time spent queuing, queues act as a rationing device (Barzel 1974) and time can be used instead of price to restrict demand. If money price equals zero, the marginal queuer will be the individual for whom the

marginal utility of time spent in the queue will equal the marginal utility of medical care to be received. The cost of care is then the opportunity cost of the time spent queuing.

Recently, attention has turned to the waiting list. Cullis and Jones (1985) have discussed several (competing) economic explanations for waiting lists in the NHS. These include the existence of a gap between the individual and the social costs of NHS use, the 'crowding-out' of private by public provision, the income effect caused by the divorce for payment for and use of care, the agency role of doctors and shifts in preferences towards higher standards of medical care. None of these arguments directly focuses on the cost of waiting lists to the consumer, although none are incompatible with positive costs of waiting list for the consumer. However, in a recent paper Lindsay and Feigenbaum (1984) (hereafter referred to as LF (1984)) focus directly on the costs of waiting lists for the demander of medical care.

The main features of the LF (1984) model can be summarised as follows. The demander of a good allocated by waiting list incurs some cost when he joins the list. Once on the list the demander incurs no cost from waiting per se (in contrast to the demander who waits physically in a queue). The mechanism that clears the market is not the time cost of waiting but the effect of delay in receipt on the value of the good. The value of a good received at a later date is lower than the value of the

good received at the present, not only because of a positive discount rate, but because the nature of some goods may mean that they are of less use at a later date.

More formally, if the value of the good to be received at the time of joining the list is equal to V_o, the value of the good at time t is

$$V_t = V_o \exp(-gt)$$

where g is the 'decay rate', the rate at which the value of the good decreases as the delay between joining the list and receipt of the good increases. The authors posit that there is some fixed cost, say c, of joining the list. This cost which does not vary with length of wait. The demander of care will compare the value of the good received at time t with this fixed cost; the marginal joiner of the queue will be the demander for whom

$$c = V_o \exp(-gt)$$

The authors argue that different goods have different decay rates. Under the assumption that the cost of joining the list is fixed across goods, the comparative statics of the model indicate first, that the length of waiting list will be inversely related to the decay rate and second, that the responsiveness of waiting lists to capacity increases is negatively related to the decay rate.

LF (1984) apply this model to the allocation of treatment in the NHS by waiting list. From the general model, they derive the hypothesis that the length of a waiting lists for treatment is an inverse function of the decay rate. This hypothesis appears to be supported by empirical investigation. In this analysis the region was taken as the unit of observation, diseases and all other hospitalisable conditions were classified into three categories on the basis of decay rates and the relationship between length of list and decay rate examined using regression analysis. A negative and significant association between decay rate and length of list was found.

The LF analysis is useful and important in that it stresses the difference, for the consumer, between allocation by queue and allocation by waiting list. However, there are a number of issues which are raised but not fully explored in the LF paper.

First, it is not possible to conclude from the estimation results that consumer response to the decay rate is the only factor determining the length of different waiting lists. Perhaps in their focus on the consumer Lindsay and Feigenbaum ignore the central role of the provider of health care in the UK system. In contrast, say, to entry onto the list for season tickets to the opera or football matches (some of the examples given by Lindsay and Feigenbaum to motivate their general analytical model), the demander of NHS medical care will

only get onto a list if referred there by a supplier of care. Therefore the length of list may be determined by the behaviour of suppliers rather than (or as much as) that of demanders. For the suppliers, waiting lists are useful to the extent that they represent a stock of work. They ensure that the scarce and skilled resources of the medical care team can be fully utilised. Additionally, lists allow suppliers to pick 'interesting' cases or to carry out their teaching duties (Cullis and Jones 1985). If suppliers act to minimize their own costs, the longer waiting lists will be for illnesses with low decay rates. The reason is that the supplier-based costs of treatment of conditions with low decay rates are not greatly increased by a delay in treatment. Therefore to minimise their own costs, suppliers will undertake other treatments first. So the greatest delay in treatment will occur, almost tautologically, for those medical conditions with low decay rates.

Second, the precise nature of the costs incurred by the consumer is not well spelt out in the LF (1984) exposition. The formal model specifies a lump sum cost of joining the queue, no cost to waiting per se and some drop in the value of inpatient care as a result of the delay in receipt of care. This model implies that the only costs of the waiting list are the initial joining cost and the fall in the value of treatment. In other words, the wait itself has no costs. However, it would appear that there are costs to waiting lists which are not the result of the

deterioration of the value of the final treatment. First, almost tautologically, individuals on a NHS waiting list are in a poorer than normal health state. Therefore they may not be able to carry out all their usual activities. It might be expected that this restriction will be associated with a positive cost. The total cost of such a restriction will obviously increase as the wait increases. But this cost is not the same cost as that which arises as a result of the deterioration of the demander's health during the wait for treatment. In fact, a situation could be envisaged in which the demander's medical condition remains stable, so the decay rate is zero. In this case, the LF cost is also zero. But if the medical condition prevents, say, the demander from working, the cost of waiting is likely to be positive rather than zero.

Second, waiting for medical treatment, about which the consumer is likely to have relatively little information and for which the precise outcome may be uncertain, may be associated with anxiety. Again, this anxiety has a cost which is not necessarily related to the final outcome of treatment. Third, the LF (1984) analysis assumes that the date of receipt of treatment is known. However, despite an increase in the proportion of booked cases, i.e. those cases which are given a firm date for admission, it is generally not possible for patients to choose the date of admission within the NHS. This uncertainty of admission date may cause anxiety and so be a cost for the demander of care. Again, this is a cost to

waiting which is not related to the final outcome of treatment. Finally, the 'non-decay rate related' costs discussed here may be borne both by the demander of care and by the family or friends of the demander.

These additional issues do not invalidate the LF (1984) analysis, but they prompt reassessment of the assumption that the costs of waiting per se are zero. Later in this work we return to a more detailed examination of waiting list costs (Chapter 6). More generally, the hypothesis put forward and tested in this thesis is that the use of time as an allocative mechanism in the NHS, in the form of queue or waiting list, imposes positive costs on the demander of care.

3. THE RESEARCH PRESENTED IN THE THESIS

The organisation of the thesis is as follows. In Chapter 2 we develop an analytical model of the non-corporate demand for health insurance in the British health care system. The term non-corporate refers to that demand which is not funded by the employer of the insured. This analytical model incorporates the assumption that waiting lists and queues are associated with positive demander-based costs. The predictions of the model are tested by means of a computer simulation and by econometric estimation using cross-sectional data from the 1982 General Household Survey. The simulation is presented in Chapter 3, the estimation presented in

Chapter 4. In Chapter 5 we turn our attention to the corollary of the demand for insurance; the demand for private health care by those covered by health insurance. Ideally, this demand should be analysed simultaneously with the demand for health insurance. Lack of data prevents such a course of action. Instead, we develop a model of demand for private sector medical care conditional on health insurance cover. This model is estimated using data provided by the largest private health insurer in the UK market.

In Chapter 6 we return to the issue of waiting lists and demander costs. We analyse the disutility for the demander of waiting for treatment for a medical condition with a near zero decay rate. We seek an estimate (or rather a set of estimates) of the monetary value of this disutility. To obtain such estimates, we adopt a behavioural model which has been extensively used to analyse the value of time spent in various transport modes. The nature of the UK health care system means that there is no data on observed actions with which to estimate the behavioural model. Instead, we use data on the stated intentions, rather than the revealed actions, of users and potential users of the health service. In the concluding chapter of the thesis we bring together the principal findings of the three components of the research and discuss possible extensions to the work.

CHAPTER 2

THE DEMAND FOR HEALTH INSURANCE IN THE UK: A THEORETICAL MODEL

INTRODUCTION

In this chapter we present a theoretical model of the non-corporate demand for health insurance in the UK. The term non-corporate demand refers to demand which is not wholly or partly paid for by an employer. The purpose of the model is to analyse the demand for health insurance in a health care market dominated by a public supplier which allocates care on the basis of need, by queue and waiting list. The private sector provides a limited substitute for public care and insurance provides reimbursement for the medical costs of a limited set of private sector treatments.

Research has examined many aspects of the economics of health insurance. However, the nature of demand for insurance in a health care system in which most care is provided in the public sector has received little attention. In the existing body of research few researchers have made any distinction between the nature of public and private care, other than the obvious difference in the money price of the two types of care. Yet in a health care system in which contributions to the

public sector are mandatory, to exist the private sector must distinguish its care from that provided in the public sector. Previous work has generally focused upon the optimal interior level of insurance purchase. But in a market in which purchase of private health insurance does not prevent the demander from using the public sector, analysis of the discrete choice between some and no insurance may be as, if not more, relevant than the analysis of the optimal interior level of private cover.

We seek to model the essential features of the UK market as it currently operates. With this aim, we pay particular attention to the attributes of care provided in the two sectors, to the limited nature of the private sector and to the specific features of health insurance contracts. We model the decision to purchase insurance as a two stage process. In the first stage, the consumer decides on the optimal level of insurance cover. In the second, he compares the level of expected utility under insurance with the expected utility under no insurance. Only if the former is larger than the latter will insurance be purchased.

The organisation of this chapter is as follows. In Section 1 we review the main features of the UK private health insurance market and the contracts provided in this market. In Section 2 we outline previous research into the demand for health insurance. As indicated above, much of this research is not directly relevant to the UK market. The model of demand is presented in Section 3

and the analysis of the effects of changes in exogenous variables on insurance demand is given in the fourth section. Section 5 concludes the chapter.

1. THE UK PRIVATE HEALTH INSURANCE MARKET

The nature of the UK private health insurance market differs in several important respects from that of other European or North American health care markets. The UK market is small. Estimates for 1986 (the latest available at time of writing) suggest that about 9.5 percent of the population is covered by insurance, and that there are about 2.5m policy holders (Laings, 1987). Policy holders in the UK are referred to as subscribers. Subscribers can be divided into three groups; individual purchasers, individuals who pay their own premia but are enrolled through their employer (referred to as employee or group purchase) and individuals covered by employer purchased cover (referred to here as corporate cover). In 1986 (for the three largest provident companies only), approximately 27 percent of subscriptions are individual, 18 percent employee purchase and the remainder are corporate, paid for either in part or totally by an employer.

The suppliers of insurance can be divided into two groups; the not-for-profit 'provident' suppliers who currently account for about 86 percent of subscribers and 90 percent of premia paid (Laings, 1987), and the more

recent for-profit entrants. The market has been historically dominated by one supplier whose market share has fallen since the late 1970s, but which still accounts for over 50 percent of the market (Grant 1985) . The expansion of the for-profits appears to have been mainly into the provision of corporate subscriptions.

The number of policies offered by each company is very limited (two or three policies to each type of subscriber) and the benefits provided to the different groups of subscribers very similar. The benefits provided by a policy are reimbursement for the medical and nursing costs of treatment. The benefit levels are designed to provide full or near full cover for both medical costs (surgeons fees, theatre costs, diagnostic tests and drugs and dressings) and daily bed costs (nursing care and the 'hotel' aspects of medical treatment). The higher cost policies provide a higher daily reimbursement rate, designed to cover the daily bed costs of hospitals with charges equal to those of London NHS teaching hospitals. No payment is made for income lost during the period of illness. In contrast to the policies offered in the American or some European markets, cost sharing devices such as coinsurance or deductibles are not part of the policy package. Coinsurance is the term used where the consumer pays a fixed proportion of the cost; deductibles are similar to the 'excess' used in the UK car insurance policies. Rather, the set of treatments for which insurance cover can be used is limited. Obviously,

insurance is not required for care not provided by the private sector, so the limited nature of the private sector itself restricts the set of treatments for which insurance can be used. In addition, private health insurance only provides cover for a limited period (generally 6 months) and does not cover long term home nursing, psychiatric or geriatric care, or primary care or preventative care, such as screening.[1,2] Finally, an upper limit on total costs is a feature of some policies, but this is set far higher than the average claim and is therefore probably more nominal than real.

Premia are 'community rated' for individual and small corporate subscribers and 'experience rated' for larger corporate subscribers. Under community rating a single premium which reflects the claims risk of a whole population is set. Typically, in the UK private health insurance market populations are defined by broad age bands. Thus under community rating the premium in the UK depends only on the age and number of persons covered by the subscription. Under experience rating the premium for a group of subscribers is set according to the risk of that group. The rationale for the widespread use of community rating would appear to be the relative size of the administrative costs of experience rating in a small market. However, the use of community rating opens an insurer up to adverse selection and 'cream-skimming' (the term referring to the situation where a competitor uses experience rating to attract the low risk subscribers).

This appears to have occurred with the entry of for-profit insurers into the market. These suppliers have concentrated their efforts on large corporate demand, for which the ration of benefits paid to subscriptions are lower than for non-corporate subscriptions (Bosanquet 1987).

Insurance markets may be characterised by two types of market failure; the first termed moral hazard, the second adverse selection. Both arise from asymmetry of information between demander and supplier. Moral hazard is the term given to the reduction in the incentive to self protection because of insurance cover (Varian 1978), although the term has been used in the North American economics of health literature to refer to a non-zero price elasticity for health care. In the US health insurance market, cost sharing devices such as coinsurance and deductibles are used to limit moral hazard, though more recently attention has turned to organisational changes intended to alter the incentives faced by the providers of care (for example Health Maintenance Organizations (HMOs) and Preferred Provider Organizations (PPOs)). However, in the UK health insurance market moral hazard may be less of a problem. There would appear to be few incentives for buyers of insurance to reduce self-protection once insurance is purchased. Insurance covers only a subset of types of care an individual may require, and chronic conditions for which the demander could neglect his/her health are generally excluded from

insurance cover. Moral hazard in the sense used in the North American health care literature would arise if the insured were able to derive more care when fuller insurance cover was purchased. However, the insurance reimbursement process and the broader health care system may serve to limit opportunities for moral hazard on the part of the demander of care.

First, in order to get reimbursement for treatment, the insured demander must generally be referred into the private sector by his/her general practitioner (GP). Dental care is treated differently. GPs are not paid for this referral. There have been few studies comparing referral rates by the insured with those of the uninsured, but a study by Gillam (1985) of referral concluded that the referral rates to private care varied across GPs as did referral rates to public care and that private referrals were perceived by GPs to have been no less worthwhile that NHS referrals. However, perhaps somewhat contradictorily, referrals made privately were twice as likely as NHS referrals to have been initiated by the patient. Second, the demander of care in the UK has been accustomed to delegate decision making to the physician. When the insurance contracts provide full or near full cover, there is no clear incentive for the patient to depart from this mode of behaviour. Finally, the type of treatments covered by insurance may itself serve to limit moral hazard. Barzel (1981) has shown that moral hazard (in the sense used in the health literature)

will be lower when insurance is provided for treatments which are substitutes than when insurance is provided for treatments which are complements. The set of treatments covered by UK insurance are broadly substitutes and treatments complementary to elective care, such as primary care, home nursing or preventative care, are specifically excluded from cover.

Whilst moral hazard on the part of the purchasers of insurance may be limited, the UK third party reimbursement system of health insurance does permit cost escalation through the actions of the suppliers of care, and the incentives are perhaps reinforced by the habit of delegation of decision making by the consumer to the provider of care. Insurance companies have attempted to tackle cost inflation, in the form of increases in treatment charges and daily bed reimbursement rates, by entering into agreements with private hospitals to fully cover their charges if they are kept down to a prior agreed level. But there are no mechanisms to limit length of stay other than a limit on total payout, which is generally well in excess of the total average costs of elective surgery, and a limit on the total number of days cover provided (generally 180 days), again well above the average length of stay for acute medical care. Maynard (1982) has argued that the private sector and insurers in UK face the same problems of cost control as other providers of third party reimbursement insurance who operate within larger health care markets.

In an attempt perhaps to minimize either adverse selection or the claims arising from adverse selection, insurance providers restrict the cover offered to demanders who may have a high probability of making a claim. Cover for the treatment of conditions which arise from medical conditions the subscriber had in the recent past (the previous 5 years) may be specifically excluded from the insurance contract. Thus the treatment of chronic conditions is not generally covered by private health insurance. In addition, insurance cover is not sold to demanders over 64 who have not previously been covered by insurance. Finally, it should be noted that an individual who is high risk with respect to all health care is not necessarily a high risk for the insurance market because of the limited nature of private sector provision.

2. PREVIOUS RESEARCH

The analysis of health insurance has been a central concern of economic analysis of private health care markets. Early research examined the existence and optimality of the health insurance market (Arrow 1963; Pauly 1974). In the context of the US market, economists have examined the welfare loss from insurance (Feldstein 1973), the optimality of levels of cover (Feldstein and Freidman 1977), the effect of insurance on the market for health care (Feldstein 1973), the effect of insurance on

the demand for self-insurance (Ehrlich and Becker 1972) and for preventative care (Phelps 1978; Nordquist and Wu 1976), and the corporate (Holmer 1984) and non-corporate (Phelps 1976; Keeler et al 1977) demand for various types of insurance. Research outside this market has been more limited, but studies have been conducted in both mixed public-private and mainly (private) market health care systems. In the European context, Zweifel (1982) modelled the demand for health insurance in Switzerland and van de Ven and van Praag (1981a) analysed the demand for deductibles in the Dutch health care system.

Each study, implicitly or explicitly, refers to some specific health care and insurance market. It is therefore, in some cases, of limited use to apply the findings of a specific study to a different type of market. Conversely, the closer the markets in nature, the more relevant the specific studies. We examine the applicability of two models of the individual demand for health insurance to the UK market. The first is one of the most frequently quoted studies of individual demand; the second is one of the few European studies and forms the starting point for the model presented in the current research.

Phelps (1976) analysed the demand for reimbursement medical insurance under two conditions that apply to health insurance in the American market. First, the insurance coverage rate must be equal in all states of the world (i.e. equal coinsurance) and second, the

insurance premium is a function of the expected payout. The level of medical care is determined by the demander and is assumed to be price and income sensitive. The consumer maximises expected utility, where the expectation is taken with respect to the distribution of health states. Health states are modelled as a single dimensioned index. The two choice variables are the coinsurance rate and the maximum limit on reimbursement given by the policy (measured in units of health care rather than money). It is implicitly assumed that a continuum of policies is available so the consumer can choose any combination of coinsurance rate (between 0 and 1) and maximum cover (between 0 and + infinity). The comparative static results of this model are frequently ambiguous. The most important findings are first that the effect of income on the demand for insurance depends not only on how risk aversion changes with income but also on the income elasticity of demand; second, that changes in the price of medical care have an ambiguous effect on the demand for coinsurance and third, that as the price of care changes, the optimal level of maximum reimbursement changes only according to income effects (Phelps 1976:131). The complexity of the results is in part a function of the assumption of endogeneity of the level of medical care (an assumption we argue below is perhaps not valid in the UK context) and in part the result of a very detailed model. The relevance of the model for the UK is perhaps also limited because of the assumption of a continuum of

insurance policies. In the UK case, only a (small set) of discrete policies are available. (Holmer (1984) has argued that the assumption of a continuum is also incorrect for the US market.) More importantly, in the UK the coinsurance rate is always high, if not equal to 1, and the decision variable in the insurance contract is not the maximum total amount of medical fees to be reimbursed but the maximum daily bed rate (as the upper limit on total costs is very high compared to average costs of private sector treatment).

Zweifel (1982) proposed a model with the following features. The model explicitly distinguishes between three types of medical care; ambulatory care, elective hospital care and emergency hospitalisation. The level of care in the latter two states is considered a random variable by the demander; the amount of care is determined by the physician acting in response to the patient's state of health and also, for non emergency care, to the patient's insurance cover. The typical insurance policy offers only the choice of a maximum daily bed reimbursement rate and an upper limit on treatment costs. Coinsurance is exogenous to the demander (it is set by law in Switzerland to 10%). The comparative static results tend to be of ambiguous sign, but as in the Phelps model, this is only to be expected in a complex model which deals with an individual's response to risk. However, unlike the American model, the results of the European analysis can be given plausible interpretations in terms of the

demander's subjective assessment of the probability distribution of states of ill-health and his/her degree of risk aversion. There are no interactions between the price of care and income and the demand for care.

The distinction between the different states of the world and the assumption of exogeneity of care in the Zweifel model is a useful starting point for an analysis of the UK case. However, in the UK market, it is not possible to choose the level of daily bed care reimbursement separately from the maximum amount reimbursed for treatment costs. More importantly, the Zweifel model does not incorporate a public alternative to private care. It cannot therefore be used to analyse the effect on insurance demand of changes in the attributes of care given in the public sector. To analyse the demand for insurance in the UK market, it is necessary to explicitly consider the role of the public sector and the limited range of discrete insurance contracts available. In this context, the important decision is not the optimal interior level of cover but the discrete choice of some or no insurance. In the next section we present a model which explicitly addresses these issues.

3. A MODEL OF THE DEMAND FOR INSURANCE

3.1 Framework for the model

Our intention is to develop a model which

incorporates the essential features of the UK system but omits unnecessary detail. At its simplest the issue we consider is as follows. Consumers essentially face a choice between purchase of some and no insurance in a market in which the private sector provides only a limited alternative to the public supplier of health care. Tax payment for the finance of the public supplier is mandatory. We make various assumptions in the development of the model. We now present these and discuss their validity.

We assume that public and private care differ in terms of time spent waiting for care, the money cost and the consumer orientated attributes of care. Care in the two sectors may differ in terms of cost and quality of 'hotel services', but there is no difference in the effect on final health status. The labour employed in the two sectors is drawn from the same pool of labour. We assume the quality of medical treatment is therefore the same and that the quality of medical treatment received is the only determinant of health status. This implies that waiting lists in the NHS do not alter the final outcome of treatment, but only the costs associated with receipt of treatment, and the length of time taken to recover from illness within the treatment period.

There is little evidence to test this assumption. Measures of outcome are not widely used in the health care sector. The results of peer reviews of outcome of treatment carried out in the NHS are generally not widely

publicised (Devlin and Lunn 1986). There are no direct comparisons of outcome of treatment in the public and private sector in the public domain. It is accepted that consumer knowledge about health care and health insurance is limited, even in the North American market (Marquis 1983). To our knowledge, there have been no studies in the UK of the information/beliefs demanders of care have about final outcomes of treatment in the two sectors. However, as part of the pilot work for the study of the costs of NHS waiting lists discussed in Chapter 6 of this thesis, twenty three respondents were asked to state the differences they perceived between the public and private sectors. Most individuals, and all who had considered the purchase of insurance, were able to identify differences between the public and private sectors in levels of comfort, convenience and choice of specialist or hospital, but few mentioned differences in quality of medical treatment. When quality differences were mentioned, it was generally stated that treatment in the public sector was at least as good as that in the private sector. Hence, it seems reasonable to make the assumption that the potential demander of insurance perceives no difference between the sectors in terms of final outcomes (as measured in health status at the end of the period). It should be noted that this assumption does mean that the current model cannot be used to analyse the use of the private sector for treatments with very high decay rates (e.g. heart surgery on small children). As at present

this is a minor part of private sector activity we do not feel this omission will alter the overall applicability of the analysis.

The level of care is assumed to be exogenous to the demander.. Consumers initiate care, but thereafter accept their doctor's advice. Thus moral hazard on the part of the demander is not considered. In the basic model the level of medical care is modelled as a function only of the level of sickness. However, it is possible, as argued above, that suppliers of care do give different levels of care in the two sectors and the model can easily be extended to incorporate length of stay in the private sector as a positive function of the level of insurance cover.

As the level of reimbursement for treatment costs is either fixed across contracts (for certain aspects of treatment) or is a function of the level of cover provided for the daily room and nursing charges, we assume that demander can only choose the daily reimbursement rate. The higher the rate, the higher the level of cover for all costs of treatment. In the model we assume that any level of cover can be chosen. This is a departure from the reality of the discrete set currently available, but as the primary focus of the model is on the discrete decision between some and no insurance, this approximation does not in fact alter the substantive results. However, it permits analysis of the costs and benefits of higher or lower levels of insurance cover for the demander without

altering the basic analytical framework, and so allows us to examine the effect of the introduction of coinsurance within the UK health care market.

A single period framework is used, incorporating the assumption that health status is the same at the end of the period regardless of the sector in which treatment is taken. A one period model would not have been appropriate had the cost of insurance in period t been a function of the utilization of insurance in period t-1. However, in the British market (as outlined above) the cost of insurance is not a function of insurance usage in the previous period. No-claims bonuses or reductions in premia for long-term subscribers are not a feature of the UK market[3]. Except for subscribers of over 64 years of age, there is no penalty for non purchase in previous periods.

Costs and benefits which fall on family members other than the demander may affect the utility of the potential demander of insurance. The decision making unit is therefore taken to be the family unit and the family is assumed to have a single utility function.

Insurance provides reimbursement for the monetary costs of private sector medical care, at a cost of a premium paid in all states of the world. The alternative to insurance is NHS provided care or both NHS care and uninsured private sector care. To decide whether to purchase insurance, the demander must first decide on the optimal level of insurance cover and then compare the

expected utility of insurance with the expected utility of no insurance. If expected utility without insurance is greater than expected utility with insurance, the demander will not purchase insurance, even though in his/her calculation of expected utility of insurance an interior level of cover was optimal. We adopt the expected utility framework not because it appears to be the only form of 'rational' behaviour under uncertainty (for a recent survey of critiques see Machina 1983), but because it can be used to generate testable hypotheses in the present context.

The demander is assumed to derive utility from income and healthy time, both of which are functions of the state of health and the sector (public or private) in which medical care is received. With subjective probability p, an individual requires either no medical care or only ambulatory care that could be provided by a GP. With probability (1-p) he/she requires secondary medical care. If this state occurs, the demander has some level of illness. Illness is modelled as a single dimensioned index of severity. Use of a single dimension does not require that bad health itself is single dimensioned, but by adopting a single dimensioned index we assume the various dimensions can be related into a single scale (as, for example, in the QALY measure of health status (Kind et al. 1982)). We assume the state of illness to be a random variable, s, with a (subjective) distribution f(s) and range 0 to +infinity. The greater

the value of s, the poorer the state of health. A critical value of s, s*, can be defined. At s* emergency admission to hospital is necessary.

From this framework three states of nature can be defined. In the first, s=0 (this occurs with probability p) and either no medical care or only ambulatory care is required. In the second, $s<s^*$, and elective hospital care is required. In the third, $s \geq s^*$ and the level of ill-health is such that immediate hospitalisation is required. The private sector does not provide treatment for $s \geq s^*$, provision therefore exists only for states of ill-health in the second state of nature. In the analytical model, s* is defined exogenously, by the nature of the private sector. This assumption can be relaxed but only adds complexity to an already complex model. However, in the simulation of this model which follows (Chapter 3) s* is defined endogenously. It should be noted that over time, as the private sector has expanded, s* has risen. However, this dynamic process is not important for the consumer considering policies which provide cover for one year only.

We now turn to a more formal exposition of the model, beginning with an exposition of the arguments of the utility function in each sector in each state of the world.

3.2 Arguments of the utility function in each sector in each state of the world

The arguments of the utility function, income and healthy time, depend on the three states of the world, the sector in which treatment is taken (public and private) and the method of reimbursement (insurance or no insurance). We examine income and healthy time in each state of the world in turn. In the first state of the world, care is only provided in the NHS, so treatment and healthy time are the same under insured or non-insured care. As treatment is taken in the NHS, there are no direct financial costs of care. However, as the insurance premium is paid in all states of the world, income under the insured prospect is lower than under the uninsured option. The income and healthy time under the uninsured prospect are given by

$$Y = wW \tag{1}$$

$$H = T - W \tag{2}$$

and under the insured prospect are given by

$$Y = wW - R \tag{3}$$

$$H = T - W \tag{4}$$

where

Y = income

w = wage rate per hour

W = hours of work

H = healthy time

T = total time in one day

R = insurance premium (defined below)

As modelled, the consumer derives no direct utility from work; work is undertaken only to derive income. As a consequence it is also assumed that the healthy time the consumer wishes to maximise is healthy leisure time; being sick at work only has disutility if it results in a loss of income. It is assumed that the choice of hours of work is made prior to the decision about insurance purchase, and that the total hours in the day are fixed.

The restrictions on the second state are more complicated. Both income and healthy time are functions of the level of sickness, the sector in which care is received and the financing arrangements for care. Examining NHS care first, the restrictions are

$$Y = w[W - a.g.L(M(s),\bar{Q}, q)] \quad (5)$$

$$H = T - W - (1-a)L(M(s), \bar{Q}, q) \quad (6)$$

where

a = proportion of sick time taken during normal working hours

g = proportion of sick time taken at work that is deducted from income

L(.) = time lost from sickness (assuming medical care to be taken)

M(.) = length of stay in hospital (in days)

$\bar{Q}$ = quality of 'hotel services' (exogenous)

q = length of waiting list (random variable)

s = level of sickness.

Under private uninsured care, the restrictions are

$$Y = w[W - a.g.L(M(s), Q,0)] - m(Q)M(s) \quad (7)$$

$$H = T - W - (1-a)L(M(s), Q,0) \quad (8)$$

where

m(.) = daily cost of hospital stay

Q = quality of 'hotel services' (choice variable)

Other symbols as above

Under insured (private) care, the restrictions are

$$Y = w[W - a.g.L(M(s),Q,0] - [m(Q)-b]M(s) - R \quad (9)$$

$$H = T - W - (1-a)L(M(s), Q,0) \quad (10)$$

where

b = maximum daily reimbursement rate provided by insurance policy

R = insurance premium

Other symbols as above

The assumed signs of the first derivatives of the

length of stay, quantity of medical care and costs of medical care functions are:

$$\frac{\delta L}{\delta s} > 0, \quad \frac{\delta L}{\delta Q} < 0, \quad \frac{\delta m}{\delta s} > 0, \quad \frac{\delta m}{\delta Q} > 0. \tag{11}$$

In more detail, the assumptions made in these restrictions are as follows. A rise in the severity of illness, s, increases the length of stay, L. The amount of time lost due to sickness, L(.) is reduced by medical treatment. This treatment has two dimensions, length of stay, M, which is a positive function of the level of sickness and is exogenous to the demander, and quality of care, Q. The higher the quality, the lower the length of stay for any s and M. However, the higher the quality, the higher the daily hospital charge m.

Quality can be chosen in the private sector but is fixed in the NHS. Quality refers not to medical treatment per se but to the 'consumer orientated' attributes of care. Access to medical treatment in the NHS is determined by waiting list and queue, which are modelled as stochastic. The exact length of wait is assumed unknown to the demander of care, but the distribution of length of wait is assumed to be known by the demander. The distribution is given by the function h(q). The effect of a wait is to increase the amount of time lost for any state of illness, s. This fairly general specification has the advantage that problems of non-exclusive use of time spent on waiting lists are overcome.

A proportion of the time lost due to illness may occur in work time (the amount is given by parameter a of the model). The effects of this time loss on income are determined by the conditions of employment. For some individuals no income loss will result, and for others all the value of the time lost at work will be deducted from income. This variation is modelled through the use of parameter g, which ranges from 0 to 1. The time loss associated with any level of ill-health, s, is larger under NHS treatment as a result of the queues for care. This will affect both healthy time and income (provided $a \neq 0$ and $g \neq 0$). The monetary costs of medical care affect the income argument under private non-insured care and under private insured care if insurance cover is less than full. Under non-insured private care income is reduced by the full cost of care, under insurance it is reduced by the difference between the insurance payout, b, and the price of care, m(Q). The price of care is a function of the quality of the hospital in which care is taken. Under insurance, income is also reduced by the premium (as in all three states of the world).

In the third state of the world, the consumer requires immediate hospitalisation. He/she cannot work and his/her income is exogenously determined by the conditions of his/her employment or the social security arrangements for sickness. The private sector does not provide emergency care, so only NHS care is available. The only difference between insurance and non-insurance is

the payment of the premium. Thus for the uninsured option, the income and health restrictions are:

$$Y = \bar{Y} \tag{12}$$

$$H = T - L(M(s), \bar{Q}, 0) \tag{13}$$

and under insurance,

$$Y = \bar{Y} - R \tag{14}$$

$$H = T - L\,(M(s),\ \bar{Q}, 0) \tag{15}$$

where

$\bar{Y}$ = exogenously determined income of demander when he/she cannot work

Other symbols as above.

The zero value for queues reflects the fact that hospitalisation is immediate.

On the basis of these restrictions, we can now examine the insurance decision. We begin with an examination of the expected utility and choice of optimal coverage of insurance (assuming a continuum of coinsurance is available). We then move to an examination of the expected utility of no insurance. In Section 4 we turn to an examination of the factors which affect choice between the two prospects.

3.3 The expected utility of insurance

Insurance cover can be used only in state 2, where it can be used to reduce the financial costs of private sector care. The insured can choose between hospitals of different quality; the higher the quality the higher the cost, so the higher must be the level of insurance to cover the direct financial costs of care. Hence, ex ante, the consumer must choose the level of quality of hospital in which he/she wishes to be treated and the level of cover he/she desires. Formally, the problem is given as

$$\max_{Q,b} \quad EU = pU(Y,H) + (1-p)\int_0^{S^*} U[Y(s),H(s)]f(s)ds + (1-p)\int_{S^*}^{\infty} U[\bar{Y},H(s)]f(s)ds$$

where Y, H, H(s), Y(s) and $\bar{Y}$ are defined as in equations (3), (4), (9), (10), (14), (15), p is the probability of not requiring secondary care, and f(s) is the distribution of sickness.

We follow Phelps (1976) and Zweifel (1982) by assuming that the states are linked through specification of the insurance premium. The premium is a function of expected payout and some loading factor representing administrative costs.

Thus

$$R = (1 + \Theta)\int_0^{S^*} [bM(s)]f(s)ds$$

where Θ is the loading factor.

For an interior optimum we require

$$\frac{\delta EU}{\delta Q} = 0; \quad \frac{\delta EU}{\delta b} = 0; \qquad \begin{bmatrix} \frac{\delta^2 EU}{\delta Q^2} & \frac{\delta^2 EU}{\delta Q \delta b} \\ \frac{\delta^2 EU}{\delta Q \delta b} & \frac{\delta^2 EU}{\delta b^2} \end{bmatrix} \quad \text{neg. definite}$$

The first order necessary condition for Q is:

$$\frac{\delta EU}{\delta Q} = \frac{\delta}{\delta Q}\left[pU(.)f(s)ds + \int_o^{s^*} U(.)f(s)ds + \int_{s^*}^{\infty} U(.)f(s)ds\right]$$

$$= p.0.f(s)ds + (1-p)\{\int_o^{s^*} \delta U(.)/\delta Y.\delta Y/\delta Q.f(s)ds +$$

$$\int_o^{s^*} \delta U(.)/\delta H.\delta H/\delta Q\ f(s)ds + \int_{s^*}^{\infty} 0.f(s)ds\}$$

$$= \int_o^{s^*} [U_y(-w.a.g.\delta L/\delta Q - \delta m/\delta Q.\ M(s))$$

$$- U_H(1-a)\delta L/\delta Q]\ f(s)ds$$

$$= 0 \qquad (16)$$

The zero terms for states requiring either primary care or emergency care reflect the lack of private sector provision for care in these states of ill-health. Rearranging (16) we derive:

$$-[\int_o^{s^*} U_y(w.a.g.\delta L/\delta Q)f(s)ds + \int_o^{s^*} (U_H(1-a)\delta L/\delta Q)f(s)ds]$$

$$(+)$$

$$= \int_o^{s^*} U_y \delta m/\delta Q.M(s)df(s)ds$$

$$(+)$$

the interpretation of which is that the consumer will increase the quality of hospital until the marginal utility gain due to increases in both healthy time and income is equal to the marginal utility loss from the increase in the price of care.

The second necessary condition is

$$\frac{\delta EU}{\delta b} = \frac{\delta}{\delta b}\left[pU(.)f(s)ds+(1-p)\left\{\int_0^{s^*}U(.)f(s)ds + \int_{s^*}^{\infty}U(.)f(s)ds\right\}\right]$$

$$= p\frac{\delta U}{\delta Y}(.)\frac{\delta Y}{\delta b}f(s)ds + \int_0^{s^*}\frac{\delta U}{\delta Y}(.)\frac{\delta Y}{\delta b}f(s)ds + \int_{s^*}^{\infty}\frac{\delta U}{\delta Y}(.)\frac{\delta Y}{\delta b}f(s)ds \qquad (17)$$

$$= 0$$

The lack of terms in $\delta H/\delta b$ reflect the lack of impact of insurance reimbursement on the amount of healthy time.

To evaluate (17), we need to specify $\delta Y/\delta b$ in each state,

$$\frac{\delta Y}{\delta b} = \begin{cases} -(1+\theta)\int_0^{s^*}M(s)f(s)ds, & s=0 \\ M(s) - (1+\theta)\int_0^{s^*}M(s)f(s)ds, & 0 < s < s^* \\ -(1+\theta)\int_0^{s^*}M(s)f(s)ds, & s^* \leqslant s < \infty \end{cases}$$

The first and third terms are negative, the second positive provided the loading factor is not large. In the UK the administrative costs of the insurance companies appear to be about 12 percent, so we maintain the

assumption that the second term is positive. Letting

$$(1+\Theta) \int_0^{s^*} M(s)f(s)ds = \delta R/\delta b,$$

the component parts of equation (17) can be signed as

$$\begin{aligned}\delta EU/\delta b = & -pU_y.\delta R/\delta b.f(s)ds \\ & + (1-p)\{\int_0^{s^*} U_y [M(s)-\delta R/\delta b]f(s)ds \\ & \qquad -\int_{s^*}^{\infty} U_y.\delta R/\delta b.f(s)ds\} \\ & = 0\end{aligned}$$

This condition states that the consumer will increase the level of reimbursement upto the point where the expected utility gain in the second state is equal to the expected utility losses in states 1 and 3.

The model can be extended to allow for moral hazard on the part of suppliers of care, by specifying the length of stay M(.), as a positive function not only of sickness s, but also of the level of insurance cover, b. The necessary condition becomes more complicated in form, but remains straightforward to interpret. This specification adds additional positive terms in the marginal utility of time and income in equation (17). If the insurance company takes into account this moral hazard on the part of suppliers, this will be reflected in a further additional term in equation (17), this term reflecting the effect of increased length of stay on the premium. If the insurance company does not anticipate

this response, then the level of insurance purchased is unambiguously greater if moral hazard (on the part of the suppliers) exists and the consumer expects/knows of the suppliers actions.

The location of the optimum of Q and b, whether supply side moral hazard is present or not, depends upon the demander's subjective assessment of the probability distribution of illness, f(s), the relationship between the payout and the premium, and the marginal utility of income in each state. Insurance will be less attractive to individuals who think that they face a distribution of health states which has more weight in the tails than in the centre. Zweifel (1982) derived the same basic result in his more complex model. Finally, regardless of the distribution of health states, if insurance premiums are community rated, individuals who are bad risks within any one community will be more likely to buy insurance than those who are good risks.

3.4 Expected utility of no insurance

Once the individual has chosen his/her optimal level of insurance cover, he/she must compare the expected utility from insurance with the expected utility from no-insurance to ascertain whether there is any benefit from insurance purchase. If uninsured, the consumer can choose between private and public care once the state of ill-health is revealed. If the utility of uninsured private

care is greater than that of NHS care it is that assumed the consumer will choose private care. The expected utility of uninsured care is then a function of the private care taken in some states of ill-health and NHS care in others.

As private sector care only exists for non-urgent hospital treatments i.e. for s such that $0 < s < s^*$, we need only examine the choice between uninsured private and NHS care in the second state of the world. For any s in this set, the consumer will choose private care if

$$U[Y(s,\tilde{Q},m),H(s,\tilde{Q},0)] \geq \int_0^\infty U[Y(s,\bar{Q},q),H(s,\bar{Q},q]h(q)dq$$

where

$Y(s,\tilde{Q},m)$ = income if private sector (uninsured) care is taken

$H(s,\tilde{Q},0)$ = healthy time if private sector (uninsured) care is taken

$Y(s,\bar{Q},q)$ = income if NHS care is taken

$H(s,\bar{Q},q)$ = healthy time if NHS care is taken

$\tilde{Q}$ = quality of private sector hospital, chosen by demander if not insured

m = price of treatment in private sector hospital

$\bar{Q}$ = quality of NHS care (not a decision variable for demander)

h(q) = distribution of waiting list time

q = time spent on waiting list (or in queues)

To identify those situations in which the consumer will choose private non-insured care and those in which

the consumer will choose NHS care, the joint distribution g(s,q) must be defined. For simplicity, we have made the assumption

$$\operatorname*{plim}_{s \to s^*} g(s,q) = 0 \quad , \; q > 0$$

and

$$g(s,q) = f(s)h(q), \qquad q > 0$$
$$0 \leq s < s^*$$

Without this assumption it is not possible to distinguish, on the basis of the level of severity of illness, states of illness for which private care is preferred from states of illness for which public care is preferred. Although the length of waiting list is likely to be a function of severity of illness, the relationship is not a simple monotonic function. For analytical purposes some assumption about the relationship between severity and queue has to be made, and in an already complex model we feel the simplest assumption is be the most useful.

Using the assumed properties of the functions given in (11), and provided the price of care is a monotonic and positive function of severity of ill-health, there will exist a unique s, say $\hat{s}$, at which the consumer is indifferent between private and public care. For all $s > \hat{s}$, the consumer will choose public care, for all $s \leq \hat{s}$, private care. Note that $\hat{s}$, unlike s^*, is endogenous to

the consumer and depends on the utility function with respect to income and time. Given $\hat{s}$, the expected utility of no-insurance, denoted EU(nins) is given by

$$EU(nins) = pU(Y,H) + (1-p)\{\int_0^{\hat{s}} U(Y(s,\tilde{Q},m),H(s,\tilde{Q},0)f(s)ds + \int_0^{\infty}\int_{\hat{s}}^{s^*} U[Y(s,\overline{Q},q),H(s,\overline{Q},q]f(s)h(q)dsdq + \int_{s^*}^{\infty} U[(\overline{Y},\quad ,H(s,\overline{Q},0)]f(s)ds\}$$

4. COMPARISON OF EXPECTED UTILITY UNDER INSURANCE AND EXPECTED UTILITY UNDER NO INSURANCE

Given this framework it is possible to analyse the effect of changes in exogenous parameters on the discrete choice between some and no insurance. Since we are not analysing the effect of changes in these parameters on the optimal level of cover, this analysis does not take the form of the standard 'comparative statics' exercise as undertaken by Phelps (1976) and Zweifel(1982). Rather, we need to analyse the effect of changes in parameters on the difference in the level of expected utility of the two prospects. Letting EU(ins) denote expected utility of the optimal level of insurance cover and EU(nins) expected utility under no insurance, let

$$G = EU(ins)-EU(nins)$$

At the point of indifference between the two options G =

0. Letting z denote the parameter of interest, the sign of

$$\left.\frac{\delta G}{\delta z}\right|_{G=0}$$

indicates which option a previously indifferent individual will prefer following a unit change in z.

We can divide the parameters of interest into three groups; those affecting only the cost or benefit of NHS care, those affecting the costs and benefits of private sector care (uninsured and insured) and those affecting the costs and benefits of both sectors. In general, the nature of the problem makes it difficult to sign these effects unambiguously. For reasons of space, we omit most of the algebraic analysis, but present the main results.

4.1 Parameters affecting the net costs of NHS care

The two parameters affecting only NHS care are the level of the quality of NHS care and waiting time. An increase in the quality of NHS care will increase the relative expected utility of the non-insured prospect. As waiting time is stochastic, a decrease in waiting time can be modelled as a leftward shift in the distribution of h(q) (Hey, 1981). This is equivalent to a decrease in the expected value of q for every s. The effect is to make uninsured care more attractive. Hence for both these parameters

$$\frac{\delta G}{\delta z}\Big|_{G=0} < 0$$

4.2 Parameters affecting the net costs of private sector care and/or insured care

The utility of private sector care is affected by the price of medical care. The effect of a price increase unrelated to a change in quality (i.e. a change in the functional form of $m = m(Q)$) depends on whether the insured purchase gives full or partial cover and on the effect of a price increase on the insurance premium. If the cover provided is full (regardless of the price of care) and the insurance premium does not alter to reflect the increase in the price of care, this increase has no effect of the expected utility of insurance. If cover is less than full and/or the premium is a function of the change in price, the effect will be to decrease the expected utility of insurance. Thus we have the binary set

$$\frac{\delta EU(ins)}{\delta m} = \begin{cases} 0 & \text{for those who are fully insured if the premium does not change} \\ <0 & \text{otherwise} \end{cases}$$

To analyse the effect on the difference between the insurance and no insurance prospects we must also consider the effect on the uninsured option. The change in price will unambiguously decrease $\hat{s}$, and this will decrease the expected utility of no-insurance. Thus the

qualitative effect of an increase in the price of medical care on the choice between insurance and no insurance is not known for certain. For those with full cover who do not anticipate any change in their premium it will make insurance more attractive, but for all others the effect cannot be definitely signed. However, if the demander attaches a high probability to being in states of health such that $s < \hat{s}$, then expected utility of no insurance will fall more than if he/she attaches a high probability to the occurrence of $s \geq \hat{s}$. Tentatively, we conclude

$$\frac{\delta G}{\delta p}\Big|_{G=0} = \begin{cases} > 0 & \text{for the fully insured with no premium change who consider the probability of } s < \hat{s} \text{ to be high} \\ > 0 & \text{for those who are not fully insured} \\ < & \text{and expect } s \geq \hat{s} \end{cases}$$

An increase in the loading factor of the premium, σ, will decrease EU(ins), will not affect EU(nins), and so

$$\frac{\delta G}{\delta \Theta}\Big|_{G=0} < 0 \text{ for any } f(s)$$

4.3 Parameters affecting the net costs of both private and public sector care

These are parameters which are related to conditions of employment or to income. We consider first the parameter g which determines the proportion of time taken off work due to sickness which is deducted from

pay. The fall in EU(ins) following a unit increase in the amount of sick time that can be taken from work time without incurring a loss of income will be smaller than the fall in EU(nins) if the individual was previously indifferent between the two prospects. Thus

$$\frac{\delta G}{\delta g}\Big|_{G=0} > 0$$

The effect of a change in the relative amount of sick time taken in leisure hours and taken during work hours (the parameter a) is ambiguous. So is the effect of an increase in the wage rate. Further, the results for the wage rate are somewhat counterintuitive. Examining the effect of an increase in the wage rate, w, on the expected utility of the two prospects separately, and indicating the arguments of the utility functions within square brackets we obtain

$$\frac{\delta EU(nins)}{\delta w} = pU_y[c] + (1-p)\int_o^{s^*} U_y[d](W-a.g.L(s,\bar{Q},q))f(s)ds \quad (18)$$

and

$$\frac{EINS}{\delta w} = pU_y[a] + (1-p)\int_o^{s^*} U_y[b](W-a.g.L(s,Q^*,0))f(s)ds \quad (19)$$

where

U_y = partial deriative of U[.] w.r.t income argument

[a] = (wW-R, H)

[b] = {w[W-a.g.L(s,Q*,0)]-R, H(L(s,Q*,0))}

[c] = (wW, H)

[d] = {w[W-a.g.L(s,$\bar{Q}$,q)], H(L(s,$\bar{Q}$,q))}

Q^* = quality chosen under insurance

(We have illustrated the simplest no-insurance prospect - that in which the demander would never chose private uninsured care - for simplicity of exposition. The argument is not altered if some private uninsured care would be considered).

To examine $\frac{\delta G}{\delta w}\Big|_{G=0}$ we need to compare the terms of equations (18) and (19). Examining the arguments of the utility functions, clearly a < c. Given that it is assumed the demander is initially indifference between the two prospects, b > d (the gain from insurance cover must occur in State 2). Using these conditions

$$\frac{\delta G}{\delta w}\Big|_{G=0} = \underset{(>0)}{p\{U_y[a] - U_y[c]\}} + (1-p)\int_0^{S^*}\{U_y[b](f) - U_y[d](e)\}f(s)ds \qquad (20)$$

where

(e) = (W-a.g.L(s,$\bar{Q}$,q))

(f) = (W-a.g.L(s,Q^*,0))

and (e) ≤ (f) as L(s,$\bar{Q}$,q) ≥ L(s,Q^*,0) for all q.

The first term in (20) can be signed easily and is positive; the sign of the second is ambiguous without assumptions about the functional form of the utility function and the relative gains from insurance. However, even without these assumptions it can be seen that if

probability p is high (i.e. the demander considers him/herself unlikely to require secondary care) it is more likely that an increase in wage rate will result in an increase in the relative attractiveness of insurance. This result is somewhat counterintuitive, as insurance is less useful for those individuals than for individuals for whom p is low.

If utility is additively separable in its two arguments and the benefits from insurance in State 2 comes from gains in healthy time, rather than from gains in income (i.e. the net income costs of insurance are negative or zero even in State 2), then it is possible to unambiguously sign equation (20). In this case, the expected marginal utility of income is higher under insurance in both States 1 and 2, so that

$$\left.\frac{\delta G}{\delta w}\right|_{G=0} > 0,$$

and an increase in the wage rate will increase the attractiveness of insurance.

This result can perhaps be generalised to suggest that the more the benefits from insurance are seen in terms of gains in healthy (leisure) time, the more likely an increase in purchase following an increase in the wage rate. It is interesting to note that for individuals who do not bear any financial costs from losing work time due to sickness, the net financial costs of insurance are always negative.

5. CONCLUSIONS

It is clear that many of the analytical predictions of the model are ambiguous. In part, this is not unexpected as we have placed few restrictions on the functional forms of the model, but this ambiguity may also be the consequence of the nature of the problem. The problem is not the one-risk model frequently used in the analysis of demand for insurance, but is a more general multi-hazard model. Private insurance does not cover all the risks associated with health care. The risk associated with the monetary costs of private sector care in a particular health state may be fully reimbursed, but the associated risk of income costs is not covered at all. In addition, the consumer has compulsory insurance against the monetary cost of NHS treatment. So, in choosing private health insurance in the UK, the consumer faces a choice between two uncertain prospects rather than the choice between uncertainty and certainty. Schulenburg (1986) showed that many of the well known conclusions derived from a one-hazard model (for example, the prediction that risk averse consumers will only buy full cover if the premium is actuarially fair) do not hold in a multi-hazard model with compulsory insurance against a single risk. The model specified here differs from that used by Schulenburg, but shares the feature of compulsory insurance. It is therefore perhaps not surprising that we cannot derive unambiguous results with respect to either

changes in attitude to risk or to changes in income.

To further investigate the model we first need to specify functional forms. If data were available we could then test the model by an econometric analysis. Unfortunately, there is no data available for many of the variables of the model. Given this lack of data, there are two possible courses of action open to the researcher. The first is to choose specific functional forms and to carry out a computer simulation of the model. The second is to use the current structure of the model as a starting point for a simpler model that can be estimated using available data. This research took both courses of action. A computer simulation of the analytical model discussed here is presented in the next chapter and an econometric estimation of a simpler model is presented in Chapter 4.

NOTES

1. Market behaviour appears to reflect the actions of the leading health insurance supplier. This supplier does not appear to think that cost-sharing devices are likely to increase market share. In June 1988 it introduced a new policy which offers cover for a narrower set of treatments at a lower cost. It is not known, at the time of writing, what impact this policy has had on sales.

2. One very small insurance supplier (Health First) covers women for breast and cervical cancer screening (and treatment).

3. A company with a very small market share offers a policy with a no claims bonuses, but no competitors appear to have felt this to be an attractive marketing strategy.

CHAPTER 3

SIMULATION OF THE ANALYTICAL MODEL

INTRODUCTION

The aim of the simulation is to investigate the effect of changes in parameters of the analytical model on the difference in expected utility of the two prospects. This is analogous to an investigation of the comparative statics of the model. However, the term comparative statics is differently interpreted in the discrete choice model and the standard economic model in which the consumer can choose any level of a good. In the present discrete model, a comparative static effect should be interpreted as the effect of a shift in the distribution of a parameter on the probability of purchase of health insurance, or as a change in the proportion of the population buying insurance.[1]

The structure of the simulation problem is as in the analytical model, with two minor changes. First, in Chapter 2 the level of ill-health at which the consumer no longer uses private insured care, s*, is exogenous. In the simulation we allow s* to be endogenous. Thus s* is defined as that state of ill-health for which the utility from private care which is fully reimbursed by insurance is equal to the utility of NHS care. This removes the

need to define the boundary between the public and the private sector in terms of severity of illness. This modification adds considerable complexity to the analysis of the analytical model, but is simply achieved in computer simulation. Second, we only consider the case of full cover insurance. As it is estimated that about 95 percent of insurance claims are met in full we felt this assumption mirrored reality fairly closely.

1. THE SIMULATION MODEL

A simulation exercise allows the researcher to use different specifications for key functions of the analytical model. Different versions of the program incorporated different specifications of the following functions:

i. the utility function, specified as Cobb-Douglas or as exponential to allow for constant absolute risk aversion,

ii. the distribution of states of ill-health, f(s), specified as uniform, exponential or log-normal, and

iii. the insurance premium, specified as either related to the expected costs of private sector care or fixed.

The specific functional forms are presented in Table 3.1. A subset of the 12 possible combinations of these functions was investigated. The subset primarily was

Table 3.1

Functional Forms used in Model

Utility Functions	Notes
1. Cobb-Douglas $U(s) = y(s)^{al} h(s)^{bl}$	$al + bl = 1$
2. Exponential $U(s) = a2(1-\exp(-b2y(s)h(s))$	
Distribution of sickness	
1. Uniform $f(s) = \frac{1}{(b3-a3)}$	$b3$ = maximum of range $a3$ = minimum of range
2. Exponential $f(s) = \lambda\exp(-\lambda s)$	$1/\lambda$ = mean of $f(s)$
3. Truncated log-normal $f(s) = \left[\frac{1}{((2\pi)\sigma)^{\frac{1}{2}}} \exp\left(-1/2\sigma^2(\ln s-\mu)^2\right)\right]\frac{1}{\Lambda}$	$\Lambda = \int_b^{\infty} f(s)ds$ b = maximum of range of s
Premium	
1. Actuarily fair plus loading factor $sub = (1+\theta)p\int_0^{s^*} m(s)f(s)ds$	θ = loading factor, $0 \leq \theta \leq 1$ p = probability illness $m(s)$ = monetary costs of treatment s^* = s at which the individual is indifferent between NHS and private care when insured.
2. Fixed $sub = k$	

chosen to examine the impact of changes in the utility function. The precise forms of the functions in the model are given in the program listing in Appendix 1.

Comparative statics were sought for changes in the following sets of parameters: income, unearned and earned; the time costs of public and private sector care; the money costs of private sector care; the insurance premium; the probability of not requiring secondary care; the distribution of states of ill-health and risk aversion. The analysis of Chapter 2 yielded the following signs for the comparative statics. An increase in the costs of NHS treatment increases the probability of insurance purchase, an increase in the costs of private sector treatment decreases the probability of purchase and an increase in the premium decreases the probability of purchase. The qualitative effects of changes in other parameters cannot be determined without using specific functional forms for the central functions of the model. This is either because the qualitative impact of a change of the parameters are of the same sign for each prospect or because the effect of a unit change in a parameter on one or both of the prospects cannot be signed unambiguously.

Data sets currently in the public domain do not contain estimates of the values of certain parameters, such as the value of time spent waiting for NHS treatment or the monetary or time costs of treatment for a unit of sickness in the private or the public sector. Values chosen for these parameters were based on the values of

more easily observed related variables, such as remuneration per hour, the cost of an initial consultation with a specialist, the current premia cost and the distribution of claims in a sample of the insured. The parameters together with the starting values and the ranges used in the simulation, are presented in Table 3.2.

Two sets of results were derived from the simulation. The first was the comparative statics; the effects of a change in each of the key parameters on the level of expected utility of insurance relative to the expected utility of no insurance. These were examined under several specifications of central functions in the analytical model. The second was the analysis of the effect of a change in each parameter upon the extent of relative utilisation of the public and private sectors. We discuss each set of results in turn.

2. COMPARATIVE STATICS

Let the expected utility of insurance be denoted EINS and the expected utility of no-insurance be denoted ENO. The comparative static effect of parameter z is $\delta(EINS-ENO)/\delta z$. If positive, an increase in the parameter will increase the probability of insurance purchase, if negative, it will decrease the probability of purchase. For each parameter, the sign of $\delta(EINS-ENO)/\delta z$ was examined for the different specifications of the utility function, of the distribution of sickness, of the premium,

Table 3.2

Parameters of the Simulation Model

Type	Parameter	Symbol	Range	Initial Value
Work related	Proportion sick time taken from work	a	0-1	0.5
	Daily hours of work	w	0-16	8
	Earnings per hour	e	0-60	15
Premium related	Loading factor on premium	r	0-1	0.12
	probability of being ill	p	0-1	0.5
Costs of illness	Fixed money cost private care	ma	0-100	50.0
	Variable money costs private care	mb,mc	0-10,0-6	5.0,3.0
	Fixed time costs NHS care	la1	0-10	5.0
	Variable time costs NHS care	lb1	0-	1.0
	Variable time costs private care	lb2,lc2	0-5,0-3	0.7,0.3
Income	Unearned income	ui	1000-4000	2000
Utility	Cobb Douglas parameters	alph,bet	0-1,0-1	0-5,0-5
	Exponential parameters	alph,bet	300,0.0001-0.0005	300,0.0001
	Difference between public and private U	gam	0-5.0	2.5
f(s)	Uniform	mean,max	0,100-200	0,200
	Log-normal	mu,sig2	0.1-2,0-2	1.6,2.0
	Exponential	mean,max	0-1,100-200	0.1,100.0

Simulation programme alters parameter by 10% of the range specified. For large ranges the programme was run twice on half the range each time.

and for different values of the other parameters of the model.

Broadly, changes in the distribution of illness, f(s), had little impact upon the qualitative results. The signs of the comparative static effects of certain parameters differed under the two specifications of the utility function. This is not surprising as the Cobb-Douglas specification assumes different attitudes to risk from the exponential specification. Finally, altering the premium structure lead to changes in the signs of some of the comparative statics.

Parameters which have unambiguous comparative static effects under all specifications of the utility function, the distribution of states of ill-health, the insurance premium and the values for all other parameters of the model are presented in Table 3.3. Parameters for which the sign of δ(EINS-ENO)/δz is not constant across all specifications of the model are given in Table 3.4. Non-constancy may occur because δ(EINS-ENO)/δz changes sign as z increases, changes sign under different specifications of the key functions in the model or changes sign for different values of the other parameters of the model. In the notes in table 3.4 we indicate the impact on the comparative statics of different specifications of the key functions and values of key parameters. In general, the results confirm the predictions of the theoretical model in the case in which the comparative statics could be unambiguously signed, and

extend the predictions for cases where the comparative static effects of the analytical model were ambiguous. However, in some cases the results are quite sensitive to the particular functional forms used.

Table 3.3

Unambiguous 'Comparative Static' Effects

Parameter z	$\frac{\delta(\text{EINS-ENO})}{\delta z}$	Notes
Private sector time costs	<0	Rate of change in EINS-ENO is less if the premium is not fixed as the higher costs of the public sector increases the use of the private sector and so increases the insurance premium
Loading on premium or cost of premium	<0	Doesn't affect use of public or private sector, only costs of insurance
Wages per hour	>0	The level of (EINS-ENO) depends on the specifications of the function

2.1 Time costs of treatment

Time costs are modelled by the function $L=L(s,q)$ where s denotes severity of ill-health and q the amount of waiting time for NHS care ($q=0$ for private care). Increases in time costs in both sectors were analysed, the increase in NHS costs (time) modelled as a rightward shift in the distribution of waiting time, $h(q)$, the increase in private sector time costs as a change in the functional form of $L(s,0)$. The effect of an increase in time costs was as expected from the analysis of Chapter 2.

An increase in time costs in one sector increases the use of the other sector. When the premium is fixed, an increase in NHS time costs increases the probability of insurance purchase. An increase in private sector time costs decreases the probability of insurance purchase.

The results are less clear cut if the premium is not fixed but instead depends on expected private sector medical care consumption. In this case, an increase in NHS time costs leads to an increase in the use of the private sector. This in turn leads to an increase in the premium, which decreases the expected utility of insurance, but not of private sector non-insured care. The effect on the difference between the expected utility of insurance and no insurance depends on the level of costs of NHS care. If the costs of NHS care are low relative to those of private sector care, a small increase in NHS time costs increases $\hat{s}$ the level of sickness at

which the uninsured individual is indifferent between public and private care. The expected amount of private sector utilisation is thus increased. This in turn increases the insurance premium and so the net effect is to increase the expected utility of no insurance relative to that of insurance. Thus the probability of insurance purchase falls. If NHS costs are high, the expected amount of private sector utilisation is larger, and the expected increase in costs of uninsured private sector care is larger than the increase in the insurance premium. Thus the relative expected utility of insurance, and so the probability of insurance purchase, rises.

2.2 Cost of premium.

An increase in the loading factor, or in the cost of a fixed premium, unambiguously decreases the probability of insurance purchase, confirming the predictions of the analytical model.

2.3 Income

The demander's income can be increased through a rise in unearned income, through a rise in earning per hour and through a rise in hours worked. Changes in the first two parameters affect only the income argument of the utility function, while a change in the third increases the value of the income argument but decreases

the value of the leisure time argument. We were unable to sign the comparative statics for any of these variables in the analytical model. In the simulation, the effect of an increase in these parameters was frequently dependent upon the specification of the utility function, the relative weights given to the income and leisure arguments of the utility function for the Cobb-Douglas specification of the utility function (the parameters α and β), and the value chosen for the parameter a. This paramter determines the proportion of sick time which is taken from work time rather than leisure time (and so is one of the determinants of the extent of income loss from sickness).

The simulation indicated that an increase in wages per hour increased the probability of insurance purchase. This result held for different specifications of utility, of f(s), of the premium and of values for the set of exogenous parameters[2]. The effect of a shift in unearned income is less clear cut; the sign of the comparative static effect depends on the level of the parameter a. When parameter a is close to 1 or 0 or, when the utility function is specified as Cobb-Douglas (for all values of a) the probability of purchase increases if unearned income rises. In cases other than these, the effect of an increase in unearned income is to decrease the probability of insurance purchase.

The effect of an increase in hours worked depends on the initial base level of hours worked from which the increase is modelled. For all specifications of the

utility function, at low initial levels of hours of work, the probability of insurance purchase increases. As the number of hours rises, although both EINS and ENO increase in absolute magnitude, the relative increase of ENO is faster and the probability of insurance purchase falls[3].

As the effect of changes in income appeared to be dependent upon the value of the parameter a, we also directly examined changes in this parameter. An increase in a has a similar effect on the probability of purchase under all specifications of the distribution of states of ill-health and of the premium. But an increase has dissimilar results under different specifications of the utility function.

Under the Cobb-Douglas specification, the comparative static effect is always to reduce the probability of insurance purchase. Under the exponential specification, as parameter a is increased from initial levels close to 0 (at this point sickness only reduces leisure time), the probability of insurance purchase increases. As parameter a tends towards 1 (the point at which all sick time is taken during work hours) the probability of insurance purchase decreases. This sign reversal is not the result of an increase in the cost of insurance as this result occurs whether the premium is fixed or a function of expected claims (although the level of a at which the sign reversal occurs does depend on the specification of the premium. Rather, this sign reversal occurs because as parameter a increases the demander's

income falls and so utilisation of private sector care falls. This makes the non-insured option relatively more attractive, and so the probability of purchase of insurance falls.

2.4 Increases in risk aversion

In contrast to models of insurance in which the consumer compares a risk reducing prospect (insurance) with a risky prospect (no insurance), the consumer in the UK health market does not necessarily reduce risk in all states of the world by purchasing insurance, as private health sector care gives lower net benefits than public care at level of sickness greater than s*. We therefore did not expect that an increase in risk aversion would necessarily increase the probability of insurance purchase.

The simulation exercise (for the constant absolute risk aversion case only) showed that the effect of an increase in the risk aversion parameter was generally to increase the probability of purchase. However, at very high levels of risk aversion, the effect of a further increase in risk aversion is to decrease the probability of purchase. This result occurs because s* (the level of sickness at which the insured consumer is indifferent between private and public care) is endogenous to the model. As risk aversion increases, s* falls and eventually equals 0. The no-insurance prospect then

dominates the insurance prospect.

The results with respect to changes in risk aversion are also sensitive to changes in the levels of other parameters in the model. In particular, the effect of a change in the risk aversion parameter depends on the probability of requiring any secondary medical care (the parameter p in the analytical model). If this probability is low (in the range 0.1 to 0.3), an increase in risk aversion is accompanied by a decrease in the probability of purchase. For values of p above 0.4, the probability of purchase generally increases as risk aversion increases. The latter result is as expected, but the first result is somewhat surprising. It appears to be the case that the effect of the probability of requiring any secondary care dominates the effect of changes in the risk aversion parameter.

2.5 Increases in health risk

An increase in health risk can be modelled as a rightward shift in the mean of f(s) or as an increase in the variance of f(s). If a random variable has a lognormal distribution, the variance of that the random variable is proportional to the square of the mean (Amemiya 1973). Thus, when the distribution of states of ill-health is specified as having a log-normal distribution, an increase in risk due to a shift in the mean could not be modelled separately from an increase in

Table 3.4

Ambiguous 'Comparative Static' Effects

Parameter z	$\frac{\delta(\text{EINS-ENO})}{\delta z}$
Monetary Costs of Private Sector Treatment	>0 if premium fixed <0 if premium increases as monetary costs increase
Probability Being Ill	>0 for low levels of p, fixed and 'fair' premium <0 at high levels of p in case of fair premium
Time Costs of NHS Treatment	>0 for fixed premium <0 for low levels of time cost} premium >0 for high levels of time cost} not fixed
Risk Aversion (exponential utility function only)	>0 at low levels of risk aversion <0 at high levels of risk aversion Result dependent on probability p
Hours worked	>0 for low hours, all utility functions <0 for high hours if utility function is exponential and if premium is not fixed
Percentage of sick time taken from work	<0 for C-D utility function >0 for a close to 0 for exponential utility function <0 for a tending to 1 for exponential utility function
Unearned income	>0 for C-D utility function >0 for exponential utility function and parameter a near 0 or 1 <0 for exponential utility function and parameter a not close to 0 or 1
Mean of distribution f(s)	>/<0 for log normal distribution of f(s) <0 for exponential distribution of f(s) Results dependent on other parameters of the model

risk resulting from an increase in the variance of the distribution[4].

The simulation indicated that the effect of an increase in the mean of f(s) was in general ambiguous for both the lognormal and exponential specification of f(s) and dependent on the values of other parameters in the model. For the lognormal specification of f(s), from low initial starting levels for the mean, the effect of an increase in the riskiness of f(s) was initially to increase the probability of purchase, but as the mean was further shifted to the right, the probability of purchase fell. For the exponential distribution of f(s), an increase in the mean was generally accompanied by a decrease in the probability of insurance purchase. (We did not investigate the effect of an increase in the variance of the exponential distribution on the probability of purchase).

On balance, it appears that an increase in the mean of f(s) decreases the probability of purchase. The explanation is that as the mean of s increases, the probability that the individual will require treatment which cannot be taken in the private sector increases, so the relative expected utility of insurance falls[5].

3. RELATIVE LEVELS OF PUBLIC AND PRIVATE SECTOR UTILISATION

The simulation permits analysis of the relative

levels of utilisation of the private and public sectors. The effect of an increase in any parameter, say z, on the utilisation of the two sectors is indicated by changes in s* and $\hat{s}$ (both endogenous to the model). $\hat{s}$ is that level of sickness at which an uninsured individual is indifferent between public and private sector care. s* is that level of sickness at which an insured individual is indifferent between private sector care and public sector care. An increase in either $\hat{s}$ or s* indicates (conditional on a positive amount of medical care being required) that more care will be taken in the private sector. As predicted by the theoretical model, $\hat{s}$ is less than s* in the simulation model for all interior solutions for $\hat{s}$ and s*. However, the results of the rest of this part of the simulation exercise need to be interpreted with caution. The absolute levels of s* and $\hat{s}$ are very sensitive to the specification of the utility function, of the distribution of sickness, and of the premium. In addition, the absolute value of s* is very sensitive to small changes in some of the other parameters of the model.

The effects of increases in the key parameters on the utilisation of the private relative to the public sector are given in Table 3.5. The results indicate that relative utilisation of the private sector rises with an increase in the time costs of NHS treatment and with an increase in income (both earned and unearned). Relative utilisation of the private sector falls as the costs (time

Table 3.5

Effect of an increase in parameters on the relative utilisation of the private sector

Effect on relative utilisation of the private sector	Parameter
No change	Probability of requiring any secondary medical care Parameters of the distribution of f(s)
Decrease	Fixed and variable money costs of private sector treatment Time costs of private sector treatment Loading factor on premium
Increase	Time costs of NHS treatment Unearned income Pay per hour
Ambiguous	Hours of work Proportion of sick time taken during work hours

Note: These results hold for different specifications of the utility function, the distribution of sickness and the type of premium

and monetary) of private sector care increases and as the insurance premium increases. The relative levels of private and public sector utilisation are unchanged by an increase in the mean or variance of f(s). It was not possible to sign the effect of an increase in either hours worked or the proportion of sick time taken in work hours. Given the ambiguous comparative static results for these last two parameters this result is not surprising.

CONCLUSIONS

The simulation exercise has confirmed and extended the predictions of the analytical model. The comparative statics of the simulation are of the same sign as those of the analytical model for parameters with unambiguous effects in the analytical model. For parameters for which a specific functional form was necessary to the sign of the comparative static effect, the simulation has indicated that the comparative statics are not greatly affected by the specification of the distribution of states of ill-health. However, they are often dependent upon the choice of utility function, the specification of the insurance premium and the level of certain parameters. So, for example, the effect of an increase in earnings depends upon the relative level of time spent in leisure and in work, and the effect of a change in risk aversion depends upon the probability of being in need of secondary medical care. In addition, the effect of a change in a parameter often depends upon the initial base from which the small change is made. For example, the effect of an increase in NHS time costs is to increase the probability of insurance purchase if NHS time costs are already high; if they are low the comparative static effect has the opposite sign.

Given these results, the conclusions we draw must be tentative. In addition, they are subject to the particular specification of functional form adopted. For

those parameters of most interest, the simulation generated the following results. The effect of an increase in income, in the money costs of private sector treatment, an increase in risk aversion (if initially at a low level of risk aversion) and an increase in NHS time costs (if initially at a high level) is probably to increase the probability of purchase. The effect of an increase in the riskiness of the distribution of health states and of an increase in the money costs of private sector treatment (if the premium depends upon expected utilisation) is probably to decrease the probability of purchase.

Many of the variables of the analytical model are not easily measured. Some of the sign reversals may occur at levels of the variables which do not often occur in practice (for example risk aversion) or for combinations of levels of variables which do not occur in practice (for example the combination of high wages and the loss of a large proportion of labour income if ill). Given the paucity of accurate measures of some of the functions and parameters of the model, these issues are unlikely to be easily resolved.

However, the analytical model (or a simple version thereof) can also be tested by empirical estimation using data based on observed actions. We will not have measures of the 'not-easily-measured' variables, otherwise we could have used them in the simulation exercise, but we can identify which individuals have purchased insurance and

some of their characteristics. Such an estimation, which forms a complement to the simulation exercise is presented in the next chapter.

NOTES

1. The interpretation given to the comparative statics at the level of the individual is a change in the probability of insurance purchase. However, as the model presented in chapter 2 and simulated here is deterministic this interpretation cannot strictly be made.

2. For most of the specifications estimated, there were discontinuities in the plot of wages against (EINS-ENO) at the points at which $\hat{s}$ increased sharply and the level of (EINS-ENO) fell. Altering the specifications of the utility function or the value of the parameter a resulted in a change in the level of wages at which these discontinuities occurred, but did not change the general pattern.

3. At very high levels of wages, both $\hat{s}$ and s* fall, indicating a decrease in usage of the private sector. This is an artefact of the model specification. As hours worked increases, leisure time tends towards zero for any level of sickness. The model does not permit negative leisure time. When leisure time becomes non-positive, the level of leisure is set arbitrarily to a small positive number between 0 and 1 which is the same in both sectors. This will increase the relative attractiveness of the NHS and therefore increases the relative benefit of the non-insured prospect.

4. The parameters mu and sigm2 in the simulation program are not the mean and variance of the lognormal distribution. However, an increase in the parameter mu increases the mean and an increase in sigm2 increases the variance of the lognormal f(s). If we denote the parameters mu and sigm2 of the simulation program as μ and σ^2 respectively, the mean and variance of the lognormal distribution are (Aitchison and Brown 1957):

$$\text{mean} = \exp(\mu + \tfrac{1}{2}\sigma^2)$$

$$\text{variance} = \exp(2\mu + \sigma^2)(\exp(\sigma^2)-1)$$

5. We did not investigate the effects of changing the mean and variance for different values of the probability of illness.

CHAPTER 4

ECONOMETRIC ESTIMATION OF THE DEMAND FOR HEALTH INSURANCE

In this chapter we discuss the estimation of an econometric model of the non-corporate demand for health insurance. The econometric model is a simplified version of the analytical model presented in Chapter 2. As we were primarily interested in the discrete choice between some and no insurance and as the market currently does not offer the consumer the choice of continuum of policies assumed by the analytical model, but offers the discrete choice between at most 3 different levels of cover, we sought to estimate only the discrete choice between the insurance and the no-insurance prospects. As in the analytical model, the unit of analysis is the family as defined by the insurance suppliers (similar definition to the tax unit). The dependent variable has value 1 if the family unit has self-purchased insurance cover and 0 otherwise. The model was estimated using cross sectional data from the 1982 General Household Survey (GHS).

The organization of the chapter is as follows. We begin Section 1 with a brief summary of the effect of parameter changes on the probability of insurance purchase predicted by the analytical model and the computer simulation. We then examine measures of the parameters

which are available in the GHS. In the second section, we discuss the choice of econometric estimator. In the third, we present the results of the econometric analysis. In the final section we examine extensions to the research that are suggested by the estimation results.

1. RESULTS FROM ANALYTICAL MODEL AND SIMULATION

From the analytical model, we derived the results that an increase in the time costs of NHS care, a decrease in the insurance premium, an increase in the money cost of private sector care that did not feed through into an increase in the insurance premium and an increase in the probability of being unwell would all lead to a rise in the expected utility of insurance relative to the expected utility of no-insurance. The simulation exercise confirmed and extended the predictions of Chapter 2. An increase in the wage rate and an increase in hours worked generally increased the relative expected utility of the insurance prospect. The effect of a shift in mean or spread in the distribution of sickness and an increase in risk aversion could not be predicted unambiguously by either the analytical model or the computer simulation, though on balance we thought the effect of both would be to decrease the probability of insurance purchase.

To estimate this model, we required measures of these variables in the population. In the absence of

data collected specifically for this research, we had to use a secondary survey and chose to use the GHS. The GHS is increasingly being used to analyse the behaviour of households, families and individuals in England and Wales. It has recently been used to estimate the demand for primary health care (Puffer 1987; Winter 1987). It is an annual cross-sectional survey of approximately 12,000 households in England and Wales containing information on the age, sex, education, employment, income, medical care and health insurance cover of all household members and, although a household survey, allows the identification of family units.

The GHS has a number of advantages for the purpose of the current research over the other annual national cross-sectional survey, the Family Expenditure Survey (FES). The GHS permits the separate identification of those individuals with employer purchased health insurance cover from those with self-purchased private health cover. In contrast, as the FES is an expenditure survey, those households with corporate cover are recorded as having zero expenditure on private health insurance. So use of the FES might result in biased estimates, as the creation of a discrete dependent variable from recorded expenditure would result in a certain number of incorrectly assigned zeros in the dependent variable. Further, the GHS contains some data on health status and recent health care utilisation while the FES contains no data on these variables.

The GHS has advantages of relatively easy accessibility and a large sample size, but suffers the disadvantage common to all secondary data sets: the variables measured in the survey may not correspond exactly with those of the analytical model. However, the low incidence of health insurance purchase in the population meant collection of data for the specific purpose of analysis of the demand for health insurance was prohibitively expensive. Moreover, until the usefulness of the GHS was tested, no case could be made for the collection of such a data set.

The parameters of the analytical model are the time loss associated with each state of ill-health, the income loss associated with this time loss, the wage rate, unearned income, the probability of requiring secondary medical care, the subjective distribution of states of ill-health and attitudes towards risk. Obviously, many of these cannot be measured with any ease and none are measured directly in the GHS. We therefore have to seek proxies from those variables that are measured in the GHS.

The time loss function cannot be proxied by any GHS variables. However, the GHS can provide some measure of the cost of this time loss. Being in a state of ill-health reduces the amount of healthy time available and so the cost of ill-health is a positive function of the opportunity cost of healthy time. This may be a (positive) function of income but is also likely to be a function of

the source of income (i.e. whether it is earned or unearned) and a function of the extent to which individuals can reallocate their uses of time. A priori, the greater the number of constraints on uses of time, the higher the opportunity cost may be expected to be. Constraints on the allocation of time may arise as a result of a high proportion of time being committed to work or a high proportion of time being committed to household production. Measures of earned and unearned income were available in the GHS. Employment status, number of jobs, hours worked (or alternatively whether overtime was regularly worked), and family composition were used as proxies for the constraints on allocation of time.

The analytical model assumes that the loss of time associated with any state of ill-health depends upon the sector of treatment. The GHS provided no direct measures of these differences. Published DHSS data was also of relatively little use. Neither the number of persons on NHS waiting lists nor the average length of wait across all inpatient treatments are necessarily good measures of the time loss associated with a particular state of ill-health. The number of persons on a list gives no indication of the length of wait. The average length of wait is probably too aggregate a measure. Therefore these variables were not used in the analysis. However, as private sector facilities are unevenly distributed across the UK, it was felt that geographical location of the

family unit could be used as a proxy for the relative time costs of access to the private and public sectors.

The expected distribution of states of ill-health and the probability of requiring any secondary medical care were proxied by various self-assessed measures of health status and measures of recent utilisation of the health services. For measures of health status, respondents to the GHS are asked to rate their health, whether they suffer from any chronic conditions and whether these chronic conditions have limited the respondent's activities in the last two weeks. For measures of utilisation, respondents are asked to provide details on all household GP consultation within the previous two weeks, outpatient treatment within the previous three months and inpatient treatment within the previous year.

Measures of attitude to risk, with respect to either loss of healthy time or loss of income, are very limited in the GHS. One possible measure of attitude to risk with respect to health is a discrete variable reflecting attitudes to the health risk of smoking. A possible indicator of measures of risk with respect to income is whether or not the head or spouse of the family unit is self employed; the self employed being assumed to be less risk averse than the employed, holding income, family composition, age and health status constant. Dummies for both these variables were used in the estimating equation.

The analytical and simulation results yielded the following a priori predictions for the signs of these variables. Variables reflecting the opportunity costs of time and lower relative costs of private sector access were expected to be positively associated with the probability of purchase. Variables measuring poor health and a high degree of risk aversion were expected to be negatively associated with the probability of purchase.

2. ECONOMETRIC ESTIMATOR

2.1 Choice of Estimator

The observed dependent variable (whether or not a family unit has self-purchased health insurance cover) is binary. An estimator appropriate to a qualitative response model should be therefore be used (Maddala (1983)). In an extensive discussion of choice between known outcomes, McFadden (1974, 1981) has shown that if utility is specified as a random variable which is additively separable into a deterministic and a random component, the choice of estimator depends upon the assumed distribution of the random component. In notation

$$U(x^j,c) = V(x^j,c) + e(x^j,c) \qquad (1)$$

where U(.) = random utility of choice j

V(.) = deterministic component of utility of choice j

$e(.)$ = random error of choice j

x^j = vector of attributes of choice j

c = vector of socio-economic characteristics of choice maker

Further, if the deterministic component can be specified as a linear function of (functions of) the choice attributes and the socio-economic characteristics of the choice maker, e.g.

$$V(x^j,c) = \Sigma^k \beta^k Z^k(x^j,c) \quad (2)$$

$$= Z(x^j,c)'\underline{\beta} \quad (3)$$

where $Z^k(.)$ = known function of the attributes of good j and the socio-economic characteristics of the demander

Z' = $(Z^1,\ldots,Z^k)$, a row vector of the Z^k functions

$\underline{\beta}$ = $(\beta^1,\ldots,\beta^k)'$, a column vector of unknown parameters.

The Z^k are the variables of the econometric model and the β^k the estimated parameters. These estimated coefficients of the econometric model can then be interpreted as the weights given to each (function) of the attributes and the socio-economic characteristics in the probability of choice of a particular action. We discuss the McFadden model at more length in Appendix 2 and briefly also in Chapter 6 .

McFadden discusses choice between certain

alternatives; the choice between insurance and no-insurance is the choice between two uncertain prospects with known expected value (under the assumptions of expected utility used in the analytical model). To provide the link between the statistical and the analytical model, the McFadden discussion must be applied to choice under uncertainty. We outline a simple extension to the McFadden model that incorporates uncertainty in Appendix 2. Here we only summarise the results.

Using the same notation as above, let the expected utility of a prospect be modelled as

$$EU^j = \sum_s p_s (V_s^j + e_s^j) \qquad (4)$$

where V_s^j is the deterministic component of utility of option j in state s, and e_s^j is the random component in state s of option j and p_s is the probability state s will occur. Provided that it is assumed that the deterministic component V_s^j depends on the state only through its arguments, i.e. the deterministic component of the utility function is state independent, then the link between utility maximization and the specification of a probit or logit model is similar to the case of choice between certain alternatives, discussed in Domencich and McFadden (1975).

Modelling expected utility as in (4), the decision maker calculates the expected utility of each of the two

prospects with some error. This error is distributed independently of the deterministic component of expected utility. The difference between the errors associated with any two prospects will have some distribution; if the difference is assumed to be normally distributed then the appropriate estimator is the probit MLE, if the difference is distributed logistically, then the appropriate estimator is the logit MLE. In practice, the two distributions are very similar, except the latter has more weight in the tails. As the decision to purchase health insurance is made only once a year, we assumed the error associated with the calculation of the expected utility of each of the two prospects (insurance and no insurance) could be large, so a distribution of differences in errors with greater weight in the tails was preferred to one with less. We therefore chose to use the logit estimator.

The estimated parameters of the econometric model have an interpretation similar to the β_s^k of equation (3). In the choice between two uncertain prospects with known mean, the estimated βs can be interpreted as the relative weights of the deterministic components of the difference between the expected utility of the insurance and no-insurance prospects. Note again that this specification implies that the deterministic components of the utility function are state independent. (For more details see Appendix 2).

2.2 Choice Based Sampling

Estimation was carried out using a sample of observations from the 1982 GHS. The unit of analysis was the family, as defined in health insurance contracts and the dependent variable was binary, equal to one if the family had self-purchased cover for one or more family members and zero otherwise. Family units with any adult over 64 were excluded on the grounds that inclusion might bias the estimates, as anyone with insurance aged 65 and over had to have purchased insurance in an earlier period. As the proportion of families in the 1982 GHS with positive self-purchased cover is under 5 per cent, a random sample (say 10 per cent) of the GHS would have resulted in insufficient information on observations with a dependent variable with value 1. We therefore selected a sample by first stratifying observations (family units) into two groups on the basis of the dependent variable and then selecting different sized random samples from each group.

This procedure is referred to in the econometric literature as choice based or endogenous sampling (Manski and McFadden 1981a). While the aim of exogenous or endogenous sampling is the same - to attain more information on the decision to undertake an action - the likelihood function in the two methods of sampling, and so the appropriate MLE, differ.[1]

In choice based sampling, the data are

deliberately sampled so that one of the other outcome is overrepresented in the sample. However, this must be taken into account in the estimation, since it will obviously import some bias. The "weighted" exogenous sampling ML estimator (WESML) proposed by Manski and Lerman (1977) is a computationally simple approach to overcome this bias. To derive this estimator, it is assumed that the population proportions in each category are known. The sampling proportions are also known, since they are chosen by the researcher. The general principle of the WESML estimator is to scale down the responses overrepresented in the chosen sample by a factor equal to the ratio of the (known) population proportion to the sampling proportion and to scale up the underrepresented responses by a similarly constructed factor.

This estimator was used in the current research. Although the WESML estimator may be less efficient than estimators proposed subsequently by Cosslett (1981), it has the significant advantage of computational simplicity. (For further discussion of the issue of choice based sampling see Manski and McFadden (1981)).

When endogenous sampling is used, the researcher chooses the relative sizes of the groups with positive and zero values of the dependent variable. Amemiya (1985) and Cosslett (1981) have argued that choice of the proportion of observations with value 1 on the dependent variable to replicate random exogenous sampling is not necessarily the best sampling rule. For a binary logit model with one

exogenous variable (for a range of values for the probability distribution function of the exogenous variable and for the share in the population with dependent variables equal to one) they showed that the most efficient[2] size of the sample proportion of observations with value one for the dependent variable was one half. In other words, the sample should be drawn to obtain equal proportions of positive and zero observations on the dependent variable. Accordingly sampling rates for the two groups (families with cover, families without) were set to achieve a sample in which the proportion with positive purchase was close to 50 per cent. The final achieved sample size was 1026 family units. Of these, 464 were insured and 562 were uninsured.

3. ECONOMETRIC ESTIMATES

3.1 Model Selection

McCullagh and Nelder (1983) have stressed that a single model is not likely to dominate all others on all the criteria used to select a model. A single model therefore should be viewed as one of a set of models which have a similar fit. Selection of a model was made on the basis of theoretical validity, goodness of fit tests appropriate to qualitative models and log likelihood ratio (LR) and Lagrange Multiplier (LM) tests for specification error in logit models (Davidson and MacKinnon 1984). The

goodness of fit tests used were the pseudo R-squared defined by McFadden (1974) and for some models, the percentage of outcomes that are correctly predicted by the model (Judge et al 1981).

One version of the model is presented in Table 4.1 (referred to as Model 1). The sign and magnitude of the parameter estimates in this model are similar to those derived using both larger and smaller sets of the regressors. While certain parameter estimates are not well defined, choice of variables in the independent variable matrix was made on the basis of the LR and LM tests, rather than on the significance of point estimates. The pattern of coefficient estimates in Table 4.1 indicates a positive association between purchase and income, employment of both spouses, and location in the South East and a negative association between purchase and various measures of health, medical care utilisation and smoking. The implications of these results will be discussed in more detail below; at this point we concentrate upon the process of model selection.

Misspecification of the distributional assumptions in probit and logit models leads to inconsistent estimators. It is therefore important to test for heteroscedasticity in these models. Davidson and MacKinnon (1984) have proposed several computationally convenient score or Lagrange Multiplier tests for omission of specified variables and heteroscedasticity of known form in binary logit and probit models. Among the tests they

discuss are three asymptotically equivalent tests based on the artificial regression of the standardised residuals

$$r_i(\hat{\beta};y_i) = [y_i-(1-F_i(\hat{\beta}))]/[F_i(\hat{\beta})(1-F_i(\hat{\beta}))]^{\frac{1}{2}} \qquad (5)$$

upon the matrix $R(\hat{\beta})$ with typical element

$$R_{is}(\hat{\beta}) = [F(x_i(\hat{\beta}))F(-x_i(\hat{\beta}))]^{-\frac{1}{2}} f(x_i(\hat{\beta}))X_{is}(\hat{\beta}) \qquad (6)$$

where $F(x_i(\beta)) = \exp(x_i(\beta))/(1+\exp(x_i(\beta)))$ in the logit model, $f(z)$ denotes the first derivative of $F(z)$, x_i is a row vector of exogenous variables for individual i, β is a column vector of parameters estimated under the null hypothesis and $X_{is}(\beta)$ is the derivative of $x_i(\beta)$ with respect to β_s.

The regression of (5) on (6) i.e.

$$r(\hat{\beta}) = R(\hat{\beta})c + \text{errors} \qquad (7)$$

generates three test statistics. These are the explained sum of squares from (7), denoted LM_2, n times the uncentered R^2 from (7) and a pseudo F-statistic,

$$F_2 = ((r'r-SSR)/k)\ (SSR/(n-m))$$

where r'r is the total sum of squares from (7), SSR the residual sum of squares from (7), k the number of restrictions, m the dimension of x_i, and n the number of

observations. If there is only one restriction, the t-statistic on the column of R corresponding to the restriction is an asymptotically valid test statistic (Davidson and MacKinnon (1984)).

The specification of $x_i(\beta)$ as non-linear allows these statistics to be used to test for heteroscedasticity of known form. While the advantage of these tests over more familiar likelihood ratio (LR) tests is small when testing for single omitted variables, the LM test for heteroscedasticity is considerably simpler than an LR test. Using the LM tests discussed above we tested Model 1 (Table 4.1) against the hypothesis of heteroscedasticity in subsets of the regressors. The number of regressors in Model 1 prevented us from testing for heteroscedasticity in all regressors simultaneously. At the risk of omitted variable bias in the vector of variables causing heteroscedasticity, we classified the regressors into two groups, the income variables and the health, health utilisation and the attitudes to smoking variables and tested for heteroscedasticity in each of the three sets separately. As the properties of these tests have not been examined under choice based sampling, the LM tests were carried out using a 10 per cent random sample of the 1982 GHS, but are presented with the relevant choice based model.

The results of the tests are somewhat contradictory. The hypothesis of no heteroscedasticity of the specified form could not be rejected using the nR^2

version of the score tests, but was consistently rejected using the LM_2 test statistic. These statistics can also be used to test for misspecification in the form of omitted variables (Davidson and MacKinnon (1984)). Monte Carlo evidence presented by Davidson and MacKinnon (1984) indicated that the LM_2 test statistic rejected a true null less often than either the pseudo-LM statistics nR^2 or F_2 and less often than the LR statistic. However, this pattern was not repeated for the present reasonably large data set. The LR, nR^2 and F_2 statistics for omitted variables were always smaller than the 95% critical value, while the LM2 statistic was consistently larger, indicating that the null should be rejected.

Given this contradictory evidence for our data, perhaps the LM_2 statistic should be given less weight in the present estimation. However, the parameter estimates should be regarded as preliminary.

3.2 Parameter Estimates

While the fit of the model in terms of pseudo R^2 is not high, this is neither uncommon in cross-sectional analyses, nor is it unexpected given the discrete nature of many of the exogenous variables as measured in the GHS. The stability of the parameter estimates was examined across models with different specifications of the income variables and the estimated coefficients of

Table 4.1

Model 1 (Logit Estimates using WESML Estimator)

		Coefficient	Standard error
Constant		-3.896**	1.027
Urban		-0.409	0.289
South-East		0.308	0.27
Spouse		0.218	0.471
Class 1 or 2		0.36	0.297
Head in work		1.688**	0.647
Spouse in work		0.668**	0.325
Self-employed head		-0.299	0.441
Overtime, head		0.352	0.363
Overtime, spouse		-0.935**	0.463
Good health, head		-0.932 E-01	0.322
Good health, spouse		-0.477	0.307
Chronic illness, head		-0.260	0.303
Smoker, head		-0.244	0.265
Smoker, spouse		-0.439	0.308
Out-patient, spouse		-0.668*	0.396
GP consultation, spouse		0.388	0.397
Family earned income		-1.079**	0.361
Family earned income2		0.204**	0.057
Family unearned income		-0.400 E-01	0.309
Family unearned income2		0.115	0.081
Log - likelihood		-243.46	
Pseudo R2		0.12	
n		1026	
Heteroscedasticity			
in health variables	LM2	192.6 (14.07)	
	NR2	1.38 (14.07)	
in income variables	LM2	269.2 (9.488)	
	NR2	1.3041 (9.488)	

* p < 0.10
** p < 0.05

All variables are 0/1 dummy variables except (gross) income variables which are in logarithmic form. Variables are defined as a unit response if household in South-East England for South-East; if spouse (always female) present in household for spouse; if occupation of head classified as in socio-economic groups 1 or 2 for class 1 or 2; if head does any regular overtime for overtime, head; if spouse does any regular overtime for overtime,spouse; if reported a chronic condition for chronic illness, head; if reported good health for good health, head; if had a consultation with a General Practitioner in last 2 weeks for GP consultation.

LM2 and nR2 are Davidson and MacKinnon test statistics, calculated for 10% random sample. Critical X2 values in parentheses.

Table 4.2

Model 1 Re-estimated Using 10% Random Sample (Logit Estimates)

	Coefficient	Standard error
Constant	-4.411**	1.023
Urban	-0.468	0.322
South-East	0.408	0.304
Spouse	0.8937	0.556
Class 1 or 2	0.196	0.367
Head in work	1.911**	0.8618
Spouse in work	0.436	0.361
Self-employed head	-1.1168**	0.666
Overtime, head	0.8758**	0.411
Overtime, spouse	-0.7989	0.657
Good health, head	-0.2058	0.383
Good health, spouse	-0.14247	0.363
Chronic illness, head	-0.195	0.367
Smoker, head	0.197	0.3066
Smoker, spouse	-0.207	0.348
Out-patient, spouse	-1.154*	0.602
GP consultation, spouse	0.444	0.415
Family earned income	-1.146**	0.457
Family earned income2	0.18245**	0.737 E-01
Family unearned income	-0.393	0.377
Family unearned income2	0.160	0.377
Log - likelihood	-170.51	
Pseudo R2	0.13	
% Correctly predicted	91%	
n	621	

* $p < 0.10$
** $p < 0.05$

All variables are 0/1 dummy variables except (gross) income variables which are in logarithmic form. Variables are defined as a unit response if household in South-East England for South-East; if spouse (always female) present in household for spouse; if occupation of head classified as in socio-economic groups 1 or 2 for class 1 or 2; if head does any regular overtime for overtime, head; if spouse does any regular overtime for overtime,spouse; if reported a chronic condition for chronic illness, head; if reported good health for good health, head; if had a consultation with a General Practitioner in last 2 weeks for GP consultation.

variables other than income remained stable across these different specifications. A comparison of the WESML point estimates (Table 4.1) with those from the non-weighted 10 per cent sample (presented in Table 4.2) indicates that the signs and magnitudes of the point estimates are similar for both samples, the larger intercept in Table 2 perhaps reflecting the lower information available on the purchasers of health insurance in the random sample.

In the model of Table 4.1 the probability of insurance purchase is significantly associated with earned family (head plus spouse) income (for the range of income in the sample the estimate of the overall effect of the linear and square term for earned income was positive), and significantly and positively associated with employment of head of family and of spouse (the head being recorded as the male in two adult families in the GHS). Though not well defined, the coefficients on location in the South-East and on membership of socio-economic classes 1 or 2 are also positive.

These coefficients are all of the a priori expected sign. The simulation model indicated that an increase in earned and unearned income generally increased the probability of insurance purchase. It is interesting to note that the importance of unearned income is smaller than that of earned income. This perhaps provides some support for the hypothesis that the cost of time is a determinant of the probability of purchase. Observations with a higher proportion of income from earnings have

less ability to reallocate uses of time without suffering an income loss, so have a higher opportunity cost of time. Several different specifications of the income variable were tested. Two income variables are used in Model 1; total family earned income and total family unearned income excluding social security payments. (The unearned variable, while not a measure of wealth, is perhaps best interpreted as an index of liquidity). Model 1 was re-estimated, first, without the constraint that the coefficient on earned and unearned income of the two spouses (where present) be equal, second, replacing family earned income with earned income per hour for the head of family, and finally, without the constraint that the coefficients of earned and unearned family income be equal. These other specifications did not give significantly better fits to the data than the model presented in Table 4.1. We therefore tentatively conclude that for the purpose of health insurance purchase earned and unearned income are regarded differently, but the provider of the income (head or spouse) is unimportant.

The positive coefficient on membership of socio-economic class 1 or 2 may reflect either unmeasured income or wealth of those in higher socio-economic classes or a price effect. Individuals who purchase through group schemes organized by their employers generally pay lower premiums than those who join individually. As such schemes are more widely offered to higher paid employees

(Grant 1985), those in the higher socio-economic groups may face lower prices.

The positive effect of higher income, employment and higher socio-economic status on the probability of purchase can be seen in Table 4.3 in which estimated probabilities of purchase for different types of observation are presented. In the logit model, the parameter estimates provide an estimate of the change in the probability of undertaking the action measured by the dependent variable.

The positive coefficient on location in South-East, though poorly defined, is of the expected direction and perhaps reflects the lower relative costs of access to private sector facilities in this region.

Table 4.3

Estimated Probabilities of Purchase from Model 1

	Probability of Purchase
Single adult family, head unemployed, gross weekly income £100	1 %
Two adult family, head and spouse employed, gross weekly income £100	12.3%
Single adult family, head unemployed, gross weekly income £400	7.2%
Two adult family, head and spouse employed, gross weekly income £400	51 %

£100 per week is approximately mean income for sample.

The parameter estimates for those variables which were intended to measure the constraints on the allocation of time (overtime, self-employment) are generally not significantly different from zero and some are of unexpected sign. The estimate of the effect of head of family overtime is positive, but that of spouse is negative. We would have expected the sign of this latter coefficient to be the same as that of the coefficient of overtime of head. Also unexpectedly, the coefficient on self-employment is negative (though not well defined). A priori, it was expected that the income of the self-employed would be more affected by having to take time off work in the event of illness, so amking insurance more attractive to these individuals. However, the future stream of income of the self-employed may be less certain than that of employees, so a self-employed individual may be less likely to purchase a relatively expensive insurance policy than an employee with the same income, location and health. Self-employment may also be a proxy for lower risk aversion, in which case we would expect the sign of the coefficient to be negative, not positive. Given that this variable is possibly proxying several different factor, the poorly defined parameter estimate is perhaps not so surprising.

The inclusion of data on self-assessed health status and recent health care utilisation in the GHS was one of the reasons for choice of the GHS as the data base for this study. However, the results do not present a

clear pattern of the effect of the GHS measures of health status or utilisation on the probability of purchase of health insurance. Most of the health variable parameter estimates in Table 4.1 are not significantly different from zero. Inspection of the covariance matrices of the data and the parameter estimates for this subset of variables did not suggest that multicollinearity was the cause of the poor precision of these estimates. The problem may stem from the nature of the measures in the GHS.

The health status and utilisation variables in the GHS are broad-brush measures which indicate whether or not a respondent rates his/her health as good, whether or not he or she has a chronic condition, and whether or not he or she has used various types of medical care within a certain time period. These variables therefore serve as some indication of current health status. The simulation results suggested that the decision to purchase insurance may be related to health status in a non-linear manner. For those who are currently in very good health, the probability of requiring any medical care may be small, hence the pay-off from insurance is limited. For those who have very poor health status, private sector care may not be available. In addition, for this group, the imposition by insurance suppliers of restrictions on cover for those in poor health may reduce the expected utility of insurance, so overall the probability of purchase is probably low for this poor health group. Thus the

relationship between health status and purchase is probably not linear. It was hoped this non-linear association could be measured by modelling interactions between the various health status and utilisation measures in the GHS. Unfortunately, the results (not presented here) indicated that this appeared not to be a fruitful approach. We therefore present only the non-interaction health terms. These have an ambiguous effect on the probability of purchase.

A similar argument may account for the lack of impact in the model of the number of, or the health of, children in the household. The estimated coefficients were small and had large standard errors in all specifications of the model. (For these reasons, the children related variables were excluded from Model 1 and so the coefficients are not given in Tables 4.1 and 4.2). First, if the illnesses children are most likely to get are not covered by insurance, the health of children will not have any direct positive effect on the probability of health insurance purchase. Second, if public sector treatment for children is viewed as no worse or better than private sector treatment then again there is no benefit from the purchase of health insurance to cover children. Thus there will be no association between children's health and the probability of health insurance purchase.

Finally, in Table 4.1 it can be seen that the proxies used for attitudes to risk (self-employment,

assessment of the risk of smoking) have negative coefficients. We expected negative coefficients for these variables on the basis of the results from the simulation model, although the coefficients are poorly defined. As noted above, self-employment may be proxying a number of factors, so this may account for the small size of the coefficient.

Overall, the results confirm the positive effect of income on purchase derived in the simulation. They perhaps also give some support to the effect of the value of time, operating through employment status and the less well-defined parameter on the overtime of head on insurance purchase. Unfortunately, the impact of health status is not well-defined and is somewhat contradictory, though the negative coefficient on both the good health variables and the measures of utilisation may be some evidence of the non-linear effect found in the simulation.

4. POSSIBLE EXTENSIONS TO THE CURRENT MODEL

While several of the parameter estimates are of the expected sign, some of these are not well-defined. Although the ranking of predicted probabilities from the model is fairly consistent with the observations, the model underpredicts the probability of purchase. It may be the case that certain determinants of purchase have been omitted from the econometric model. In part, these omissions are likely to be the result of poor data, a

problem hardly unique to the present study and one frequently encountered in the analysis of behaviour in the health care market. However, the econometric results suggest that it may also be useful to extend and respecify the underlying theoretical model of choice. Below we discuss possible extensions to the current model which may increase the goodness of fit of the estimated model.

The current model has two central assumptions. The first is that choice is made on the basis of expected utility of the two prospects in the next period. Although the value and/or probability of future outcomes may be affected by past actions (for example, the probability distribution of future states of health may be a function of past states, expectations of quality of care may be a function of past utilisation of the health services) it is assumed that the decision at time is independent of all prior and subsequent decisions. The second assumption is that individuals choose, at time t, between two prospects, these being the purchase and the non-purchase of health insurance.

The estimation results suggest consumers may be rather more bounded in their decision making process. Rather than base their actions on current events (prices, income, health status) they may base their actions on past events, particularly past purchase or non-purchase. In addition, certain consumers may not perceive that they have a choice between two prospects. We explore both these issues below.

4.1 Past Purchase

Past purchase or consumption has been found to be a determinant of current consumption in demand studies and may also play a role in the decision to purchase health insurance. The decision to buy health insurance requires the evaluation of several unknowns, so the costs of decision making may be relatively high. If so, individuals may not reconsider their decision until their circumstances change considerably. If circumstances change little in the period following the initial decision, the perceived costs of re-evaluation may be greater than the expected gains. If decision makers do not alter their behaviour as the result of marginal change in either endowments or the choices they face, we would expect past purchase to be an important determinant of present consumption, and the weights on all factors to be a function of the time elapsed since the initial decision was taken. Unfortunately, this hypothesis cannot be tested using the GHS, nor any other data sets to our knowledge currently in the public domain.

4.2 Restricted Choice Sets

Restricted choice sets arise if certain individuals in a sample can choose a prospect from within only a subset of the full set of possible discrete

prospects. In the economics of transport literature this problem is referred to as 'captivity'. In the limit, captivity confines the demander to only one of the possible prospects. Captivity in transport economics can be easy to establish; for example if commuters choose between public and private transit for the journey to work and a certain group lives in a locality with no public transit, this group is likely to be captive to private modes of transit. In other words, the members of the group cannot choose a public mode. In the case of health insurance, there may be some groups in the population for whom the probability of being captive to the no-insurance prospect may be high. For example, there are individuals who do not consider the private sector as an option for political reasons. These individuals are unlikely to perceive insurance as an option for themselves. There are also those individuals who may be excluded from purchase of health insurance because of age, for example, those aged 65 and over who have not bought insurance in the past. There may also be individuals who feel their medical history is such that they would not be give insurance cover. These groups may be captive to the no-insurance prospect.

If captivity is thought to exist, one possible approach to the problem is to model the purchase decision as a two stage probabilistic process. Let us assume there are only two choices, prospects 1 and 2. Individuals can only be captive to choice 1. In our case, choice 1

represents the no-insurance prospect, choice 2 the insurance prospect.

Let p_i = probability individual i will not be captive

and F_i = probability individual i is not captive and chooses prospect 2

The probability of choice of prospect 2 is thus

$$p_i F_i$$

and the probability of not choosing prospect 2 is

$$1 - p_i F_i$$

The likelihood for the process is thus

$$L = \pi_0 (1 - p_i F_i) \pi_+ p_i F_i \qquad (8)$$

where 0 denotes those observations with zero purchase of prospect 2 and + those observations with positive purchase.

If it is assumed that p_i varies across individuals, but is independent of F_i, then the likelihood function is similar to the 'Dogit' model proposed by Gaudry and Dagenais (1979) to analyse captivity in choice of transport mode. If $p = p_i$ for all i then the model is similar to the p-tobit model used by Deaton and Irish (1984) to analyse household consumption using data in which there is systematic over- or under-reporting of expenditure.

Unfortunately, although the idea of captivity is perhaps a useful way of examining the demand for health insurance, it is difficult to establish whether or not

captivity occurs. We do not have detailed data on the choice process with which we could either support or refute the theoretical concept of captivity. Nor do we have the data to empirically test a model of captivity specified as equation (8). Several factors which may determine both the probability of captivity and the probability of choice of insurance conditional on not being captive are not measured in the 1982 GHS. For example, there is no data on political attitudes. Nor do we have detailed data on medical history of potential demanders to establish whether they might view themselves as ineligible for cover.

However, despite the lack of detailed data, we could examine the GHS data set for evidence of the effects of captivity. Swait and Ben-Akiva (1985) have shown theoretically that the effect of captivity to one prospect in a binary logit model is to bias parameter and variance-covariance estimates. If captivity is ignored, the estimated coefficients of all terms except the constant of the model will be downwardly biased and less significant than in the 'true' model. On the basis of this result we examined the data for evidence that the parameters were downwardly biased when captivity was ignored by trying to identify captive groups and re-estimating the model without these observations. This required that we could correctly identify the choice to which individuals may be captured, and that we could identify captured individuals. For the purposes of an

exploratory analysis we assumed firstly, that the compulsory nature of public health insurance, and the nature of private insurance contracts meant 'capture' was possible only to the no-insurance prospect, and secondly, that the probability of capture was a function of low income (because insurance is a relatively expensive good and low income is associated with poor health). As discussed above there, may be other factors associated with a high probability of capture, but we did not have measures of these.

We further assumed that individuals with below mean income were captive to the no-insurance prospect. We therefore stratified the sample by mean income and re-estimated Model 1 for the two groups in the sample separately. The results are presented in Table 4.4. A comparison of the coefficients in Table 4.1 and Table 4.4 gives some support for the hypothesis that the low income group are more likely to be captured. The estimate of the coefficient of the constant in Table 4.1 (estimated using the whole sample) is higher, and the coefficients of most other variables lower, than the estimates in Table 4.4 for the higher income group only. This is the pattern we would expect if captivity were present.

These results are very preliminary. Although the idea of captivity is perhaps useful for modelling the demand for health insurance, several of the factors which may determine either the probability of captivity or the probability of choice of insurance, conditional on not

being captive, are not measured in the 1982 GHS. For example, there are no data on political attitudes towards private medicine, which may affect the probability of purchase of health insurance. Nor are there data on the medical history of potential demanders which could be used to establish whether demanders would be given only limited cover or would even (erroneously) view themselves as completely ineligible for cover. We have hypothesised in the above analysis that income might be a proxy for capture, but it is not necessarily true that all low income families will not consider health insurance within their potential choice set. Finally, splitting the sample on the basis of mean income and estimating the model for each group separately reduces the number of observations used in the estimation. This reduces the probability that the estimated model will be a close fit to the data and give well-defined parameter estimates.

Table 4.4

Model 1 re-estimated using segmentation by Mean Income

	Above mean income		Below mean income	
	Coefficient	Asymptotic t - ratios	Coefficient	Asymptotic t - ratios
Constant	-2.52	(-1.056)	-4.32	(-2.41)
Urban	-0.458	(-1.14)	-0.234	(-0.45)
South-East	0.4217	(1.159)	0.0235	(0.047)
Spouse	0.065	(0.08)	0.2081	(0.23)
Class 1 or 2	0.227	(0.568)	0.4739	(0.88)
Head in work	1.555	(0.995)	1.960	(2.52)
Spouse in work	0.602	(1.34)	0.844	(1.36)
Self-employed head	-0.317	(-0.45)	-0.475	(-0.71)
Overtime, head	0.426	(0.94)	0.3115	(0.29)
Overtime, spouse	-0.87	(-1.51)	-0.563	(-0.344)
Good health, head	-0.31	(-0.65)	0.195	(0.368)
Good health, spouse	-0.54	(-1.33)	-0.44	(-0.648)
Chronic illness, head	-0.32	(-0.76)	-0.108	(-0.186)
Smoker, head	-0.097	(-0.27)	-0.436	(-0.893)
Smoker, spouse	-0.53	(-1.37)	-0.364	(-0.483)
Out-patient, spouse	-0.652	(-1.25)	-0.536	(-0.536)
GP consultation, spouse	0.448	(0.8)	0.255	(0.32)
Family earned income	-1.44	(-1.46)	-0.87	(-1.367)
Family earned income2	0.248	(2.07)	0.147	(1.12)
Family unearned income	-0.049	(-0.11)	0.017	(-0.024)
Family unearned income2	0.093	(0.708)	0.135	(0.80)
Log - likelihood	-197.67		-66.64	
Pseudo R2	0.08		0.10	
% of sample	33.6		66.4	
Heteroscedasticity in income variables LM2	9.484	(9.488)	301.3	(9.488)
NR2	0.02	(9.488)	3.23	(9.488)

All variables are 0/1 dummy variables except (gross) income variables which are in logarithmic form. Variables are defined as a unit response if household in South-East England for South-East; if spouse (always female) present in household for spouse; if occupation of head classified as in socio-economic groups 1 or 2 for class 1 or 2; if head does any regular overtime for overtime, head; if spouse does any regular overtime for overtime,spouse; if reported a chronic condition for chronic illness, head; if reported good health for good health, head; if had a consultation with a General Practitioner in last 2 weeks for GP consultation.

LM statistics calculated for 10% random sample

5. CONCLUSIONS

The estimation results indicate the importance of income and employment status in determining non-corporate purchase of health insurance. However, the research also suggests that variables other than those measured in the GHS may account for some of the variability in the probability of purchase. This led us to a consideration of two possible extensions to the current work which might increase the precision of the estimates and the explanatory power of the model. These are the inclusion of data on past purchase into the econometric model and the extension of the model to allow for captivity. Unfortunately, the data required for such research is not collected in the GHS nor in any other large scale national survey to our knowledge and so would probably have to be gathered specifically for this research. In the conclusion to the thesis we return to this issue and discuss the type of data which might be collected. Finally, this study provides a basis for comparison with future research, using either specifically collected data sets or perhaps a data set such as the FES in conjunction with the GHS.

NOTES

1. See Cosslett (1981) for a detailed discussion of exogenous and endogenous sampling and appropriate estimators.

2. Efficiency was defined as the minimisation of the ratio of asymptotic variance under the chosen sampling scheme to the variance under random sampling.

CHAPTER 5

ESTIMATION OF THE INSURANCE CLAIMS OF THE PRIVATELY INSURED

INTRODUCTION

In this chapter we model and estimate the insurance claims of a sample of the privately insured. The sample is drawn from subscriber units with individual cover and with small corporate cover, so this chapter examines the behaviour of a wider population than the analyses of Chapters 2 to 4. Ideally, the demand for private insured health care should be analysed simultaneously with the demand for health insurance, but as outlined in the Chapter 1 of this work, the data to estimate such a model is simply not available in the UK. We therefore seek to estimate the determinants of the level of claims, conditional upon insurance. We develop an econometric model which reflects the structure of the UK health care market and the utilisation of private health insurance within this structure.

In the UK context, an analysis of claims is virtually identical to an analysis of the expenditure on private secondary health care because of the near full cover provided by insurance contracts. The leading health insurance supplier (which provided the data for the

econometric estimation) estimates that approximately 95 percent of claims are met in full, and this estimate excludes any ex-gratia payments which can be (and are) made in the cases of shortfall between cover and expenditure. It is important to note that the current research analyses the level of claims/expenditure, conditional on insurance purchase. We did not attempt to estimate what the determinants of expenditure would be were all the population insured. While in principle it would be straightforward to respecify the econometric model to undertake such a task, in practice the benefits of such an exercise would seem extremely limited. If a majority of the population were covered by private health insurance, it is unlikely that either the private sector or the contracts offered by the private health insurance suppliers would be of the same form as at present.

We begin our analysis with a review of two studies of the demand for private sector medical care. We focus primarily upon the econometric specification of these studies and examine the implications of each model for the nature of demand. In the second section we discuss the structure of the claims process in the UK and from this derive a set of nested likelihood functions, each of which models the level of claims under different assumptions about the stochastic structure of the claims process. This approach serves both to highlight the assumptions which must be made to estimate expenditure and enables us to place our own work and the research discussed in

Section 1 into a common scheme of classification. In Section 3 we discuss the factors affecting the different parts of the claims process and the data sources for the econometric analysis. The estimation results are presented in Section 4.

1. PREVIOUS ESTIMATION OF THE DEMAND FOR HEALTH CARE

There have been many studies of the demand for medical care (for reviews see Cairns and Snell (1978), Newhouse (1981), Culyer at al (1988)). We review only two of these studies. However, for our purposes they are among the most important. Both consider the nature of medical care demand; both propose and use an explicit econometric model. The first is the Rand Two Part Model (Duan et al. 1982,1984), used in the Rand Health Insurance Study, the second is the Adjusted Tobit Model (ATM) used by van de Ven and van Praag (1981b) to analyse the claims of the insured in the Netherlands. In both models the distribution of annual medical care expenditures is specified as the outcome of two actions, and both models can be classified as 'extended Tobit' models (Amemiya 1984).

1.1 The Rand Two Part Model (TPM)

The TPM (Duan et al (1982)) is an attempt to account for the existence of a proportion of the

population which has zero expenditures in any time period. The model separates behaviour into two decision. The first is the decision whether to have any expenditure. The second is the decision about the level of expenditure, conditional on expenditure being positive. More formally, the model has two equations. Let I_i^* be an unobserved index of the need for medical care, say an index of unhealthiness, for individual i. I_i^* is a linear function of variables x, such that

$$I_i^* = \delta_1 x_i + u_i \qquad u_i \sim N(0,1) \qquad (1)$$

The researcher can only observe whether or not I_i^* is positive. If I_i^* is positive then the demander of care incurs positive expenditure. Letting y_i denote the level of expenditure

$$\log (y_i \mid I_i^* > 0) = \delta_2 x_i + e_i \qquad e_i \sim N(0,\sigma^2) \qquad (2)$$

Specification of expenditure as (2) implies that expenditure must be positive or zero.

Given the distributional assumptions in (1) and (2), the likelihood function for this model is

$$L_{TPM} = \pi_0 \, 1-\Phi(\delta_1 x_i) \, \pi_1 \Phi(\delta_1 x_i) \, \pi_1 (1/\sigma) \phi[(y_i - \delta_2 x_i)/\sigma] \qquad (3)$$

where ϕ is the standard normal p.d.f., Φ the standard normal c.d.f, 0 denotes those observations which have zero

expenditure and 1 those observations with positive expenditure. The distributional assumptions on the error terms u and e made in the TPM mean that the likelihood function can be factored into two parts,

$$L_{TPM} = L(\delta_1) \times L(\delta_2, \sigma^2)$$

where $$L(\delta_1) = \pi_0\ 1-\Phi(\delta_1 x_i)\ \pi_1(\delta_1 x_i) \quad (4)$$

and $$L(\delta_2, \sigma^2) = \pi_1 (1/\sigma)\phi[(y_i - \delta_2 x_i)/\sigma] \quad (5)$$

the first term of which depends exclusively on parameters in equation (4) and the second term on parameters in equation (5). Taking logs, the TPM can be represented as

$$\log L_{TPM} = \log L_P + \log L_{OLS} \quad (6)$$

where L_P denotes a probit likelihood and L_{OLS} an OLS (ordinary least squares) likelihood function. Consistent estimates for δ_1 can be obtained from a probit estimation of (4) using all observations and consistent estimates of δ_2 from OLS of (5) using only those observations with positive values for the dependent variable.

In this model it is assumed that the same factors affect the decision to seek care and the level of expenditure on care, though the strength of these factors on these two decisions is not constrained to be equal. This may or may not be a realistic assumption. A more important assumption is that expenditure is only defined if I_i^* is positive. To see this, we can re-express

equation (2) as

$$\log y_i = \begin{cases} \delta_2 x_i + e_i & \text{iff } I_i^* > 0 \\ \text{undefined} & \text{otherwise} \end{cases}$$

Equation (2) therefore models only actual expenditure, that which is conditional on medical need, rather than potential expenditure.

1.2 Adjusted Tobit Model(ATM) (van de Ven and van Praag 1981b)

The adjusted tobit model is similar in form to the TPM, but this outward similarity masks an essential difference: the purpose of the ATM is to model potential rather than actual expenditure. Using the same symbols as above, the ATM is given by

$$I_i^* = \delta_1 x_{1i} + u_i \tag{7}$$

$$\ln y_i = \begin{cases} \delta_2 x_{2i} + e_i & \text{iff } I_i^* > 0 \\ -\infty & \text{otherwise} \end{cases} \tag{8}$$

u and e are distributed biv.$N(0,\Sigma)$

$$\Sigma = \begin{bmatrix} 1 & \rho\sigma \\ \rho\sigma & \sigma^2 \end{bmatrix}$$

where ρ is the correlation of u and e and σ^2 is the

variance of e.

The log likelihood function for this model is

$$\log L_{ATM} = \Sigma_0[1-\Phi(\delta_1 x_{1i})] + \Sigma_1\Phi(\delta_1 x_{1i}) + \Sigma_1 g(y_i | u_i \geq -\delta_1 x_{1i}) \quad (9)$$

where $g(y_i | u_i \geq -\delta_1 x_{1i})$ is the conditional probability density function of observed expenditure, 0 denotes those observations with no expenditure, 1 observations with positive expenditure. (9) can be estimated using a maximum likelihood (ML) estimator to derive estimates of δ_1 and δ_2 under the joint normality assumptions made above. Limited information estimates of δ_2 may be obtained under different assumptions about the distribution of $(e_i | u_i \geq -\delta_1 x_{1i})$ using consistent estimators of δ_1 from the first two terms of equation (9) to eliminate (asymptotically) the correlation between x_{2i} and the u_i in the observed sample. van de Ven and van Praag used the two stage estimator suggested by Heckman (1976). This estimator is consistent provided the distributional assumptions are correct, but less efficient than the ML estimator.

The ATM is a specific example of a class of models referred to as Sample Selection Models (Heckman (1976), Hay and Olsen (1984)). Sample Selection Models are designed to correct for missing observations on the dependent variable. The model specified in equations (7) and (8) does not require the factors which determine the need for care to be the same as those which determine the

level of care received. While the authors do not discuss the ideas behind the formulation of their model in great detail, positive need is defined as positive contact with a doctor in the survey period. However, since van de Ven and van Praag (unlike Duan et al.) only seek to explain the level of expenditures on specialist's and hospitals fees only, their need index is more properly described as an index of the need for specialist or hospital based treatment. This obviously is not identical to need for medical care.

The ATM, like the TPM, assumes that the observed level of care is always positive if need is positive. However, unlike the TPM, the ATM permits the researcher to test explicitly whether u and e are independent. If the error terms are independent, equation (9) can be factored into two separate equations; the first a probit model to explain whether or not need is positive, estimated using all observations, the second an OLS equation to explain the level of claims, to be estimated using only those observations with positive claims.

There has been some discussion of the appropriate model to use to estimate the demand for health care, for example, the exchange between Hay and Olsen (1984) and Duan et al (1984). The debate distinguishes between the TPM and various SSM specifications. The two types of model are not nested. In the TPM specification, the second equation models actual expenditure. In the ATM the second equation models potential expenditure and because

potential expenditure and the need for any medical care may be correlated, unbiased estimates of potential expenditure can only be derived if this correlation is taken into account. The ATM has the advantage over the TPM that is is possible to explicitly test (using loglikelihood ratio tests) whether e and u are independent, whereas the estimation of the TPM provides no such test. Further, although Duan et al. (1984) show one form the joint distribution of u and e may take, they did not test this empirically. Duan et al (1984) conducted a limited test of both models and concluded that empirically the TPM performed as well or better than the ATM, but the advantage of the former over the latter model was not large.

For the purposes of model development, the central issue is which model is more appropriate for the problem under consideration. Although Duan et al. (1984) argue that it is actual expenditure which is of interest, it is not clear that this is the object of concern, particularly in the UK situation. Presumably all individuals who buy health insurance have a latent demand for private health care; if not, then they would not have bought health insurance. However, in any one year, some of these individuals do not use their insurance, either because they do not need any medical care or because they need medical care that is not covered by the insurance contract. Therefore it would seem that it is potential, rather than actual, expenditure which is the variable of

interest. Therefore a Sample Selection model (SSM) similar in spirit to the ATM is the appropriate type of model. In addition, the SSM approach permits econometric testing of some of the distributional assumptions of the model (although van de Ven and van Praag did not do so in their estimation).

In our research we therefore use a Sample Selection approach. However, the model developed here is somewhat more complex than either the TPM or the ATM because of the nature of the UK health care system. In addition, rather than just presenting one model, we have sought to present a number of (nested) models, each based on different assumptions about the distribution of the random variables in the process of incurring positive health insurance claims. Which model is appropriate will be determined by the econometric estimation.

2. MODELS OF HEALTH INSURANCE CLAIMS FOR THE UK

The nature of the private sector and of health insurance contracts in the UK has the result that an insured individual with positive need for medical care does not automatically have a positive insurance claim. If an individual is ill, his or her first contact with the providers of medical care will be with his or her GP. Primary treatment is provided free under the NHS for all patients whether covered by insurance or not. The GP may either provide primary treatment only, which is not

covered by the insurance contract, or may refer the patient for further diagnosis or secondary care. At this stage the demander of care has a choice. He or she can either ask for this further treatment to be provided privately or can continue with treatment in the NHS sector. We assume that if the treatment is covered by the contract and the demander has not exceeded/does not expect to exceed any monetary limits on claims set in the contract, he or she will choose insured care. There is no financial penalty to this action as future levels of the premium do not depend on claims. In addition, refraining from making a claim will not necessarily prevent imposition of restrictions on future insurance cover. Restrictions on the cover provided are a function of past medical care utilisation, but the imposition of restrictions is not a function of the sector in which treatment for these conditions was received.

In the models discussed above, a positive claim was the outcome of one process. In contrast, in the UK a positive claim in the survey year is the outcome of two distinct, but not necessarily independent, processes. A positive claim is observed if the demander has both positive need for medical care and is referred to the private sector. A zero claim is observed otherwise. The statistical model describing the observed level of claims/expenditure therefore consists of three probabilistic events; the decision to seek medical care, the referral decision and the level of claims/expenditure.

2.1 The decision to seek medical care

We assume all insured have a latent need for medical care in the contract period. Denoting this need as m_1^* (and dropping the subscripts referring to the individual for expositional convenience),

$$m_1^* = \alpha z_1 + w, \qquad w \sim N(0,1) \tag{10}$$

where w is a random error, z_1 a vector of variables determining need and α a vector of weights. Need is only observed if the insured presents him/herself to a medical practitioner. Let d_1 be a dummy variable denoting this event. Thus

$$d_1 = \begin{cases} 1 & \text{iff } w \geq -\alpha z_1 \\ 0 & \text{otherwise} \end{cases}$$

2.2 Referral to the private sector

Referral can be specified as a latent variable m_2^* where

$$m_2^* = \beta z_2 + e \qquad e \sim N(0,1) \tag{11}$$

where e is a normally distributed random error, z_2 is a vector of factors determining referral and β a vector of

weights. Again, m_2^* cannot be observed directly; we can only observe whether or not a referral has been made. Let d_2 be a dummy variable such that

$$d_2 = \begin{cases} 1 & \text{if } e \geq -\beta Z_2 \\ 0 & \text{otherwise} \end{cases}$$

2.3 Level of claims/expenditure

Let y^* denote potential expenditure, where

$$\log y^* = \Gamma z_3 + u \tag{12}$$

Actual expenditure is only observed if both medical need and referral occur. In other words,

$$\log y = \begin{cases} \log y^* \text{ iff } m_1^* > 0 \text{ and } m_2^* > 0 \\ -\infty \text{ otherwise} \end{cases} \tag{13}$$

The assumption of log-normality of health care expenditure is commonly made in studies of the demand for medical care and was also made by van de Ven and van Praag (1981b).

A set of sample likelihood functions can be derived under different assumptions about the statistical relationships between the different parts of the claims process, or more formally, about the joint distributions of w, e and u. We begin by specifying the most complex model, proceeding from this to simpler models by making a

succession of assumptions about the distribution of the error terms.

The most complex model specifies that w,e and u are all jointly distributed: need and referral are not independent and the level of claims depends on both need and referral. In addition, it is assumed that referral is dependent on medical need. From equations (10), (11) and (12) the likelihood function is

$$\begin{aligned} L0 = \; & \pi_0[1-pr(w\geq-\alpha z_1)pr(e\geq-\beta z_2|w\geq-\alpha z_1)] \; x \\ & \pi_1 pr(w\geq-\alpha z_1)pr(e\geq-\beta z_2|w\geq-\alpha z_1) \; x \\ & \pi_1 g(y|(e\geq-\beta z_2|w\geq-\alpha z_1),w\geq-\alpha z_1) \end{aligned} \tag{14}$$

where 0 denotes observations with zero claims and 1 observations with positive claims and pr denotes probability.

We can derive a set of models nested within L0. First, if we assume independence between referral and medical need, but maintain the assumption that the level of claims is dependent upon both need and referral, we derive the likelihood

$$\begin{aligned} L1 = \; & \pi_0[1-pr(w\geq-\alpha z_1)pr(e\geq-\beta z_2)] \; x \\ & \pi_1 pr(w\geq-\alpha Z_1)pr(e\geq-\beta z_2) \; x \\ & \pi_1 g(y|e\geq-\beta z_2,\; w\geq-\alpha z_1) \end{aligned} \tag{15}$$

Second, if the level of expenditure is assumed independent of the need for medical care (but not of the

need for referral) then L1 can be respecified as

$$L2 = \pi_0[1-pr(w\geq-\alpha z_1)pr(e\geq-\beta z_2] \quad x$$
$$\pi_1 pr(w\geq-\alpha z_1)pr(e\geq-\beta z_2) \quad x$$
$$\pi_1 g(y|e\geq-\beta z_2) \qquad (16)$$

As the private sector provides only a limited set of types of medical care, this assumption seems reasonable. For example, individuals with high medical need may be treated in the private sector, others in the public, depending on the actual state of ill-health. L2 cannot be estimated using statistical or econometric computer software currently widely available in the public domain. However, if we are able to separate the observations with zero observed claims into two mutually exclusive groups, those who have had zero contact with a medical practitioner and those who have positive contact, but have not been referred, then L2 can be factored into two parts. This is referred to as 'sample separation' (see, for example, Blundell et al. 1986). The first part is

$$L3(1) = \pi_{ND}1-pr(w\geq-\alpha z_1) \; \pi_D pr(w\geq-\alpha z_1) \qquad (17)$$

and the second is

$$L3(2) = \pi\_1-pr(e\geq-\beta z_2) \; \pi_+ pr(e\geq-\beta z_2) \; \pi_+ g(y|e\geq-\beta z_2) \qquad (18)$$

where ND denotes those observations who have non-positive

medical need, D those observations with positive medical need, - those observations with positive medical need but no private health care expenditure and + those with positive expenditure. L3(1) therefore would be estimated using all observations and L3(2) estimated using only those observations with positive medical need (i.e. those who have visited a medical practitioner in the survey year). Consistent estimates of α can be obtained from a probit estimation of L3(1) and consistent estimates of β and Γ from estimation of L3(2) using either maximum likelihood or a Heckman-type two stage least squares estimator (Heckman (1976)). Note that L3(1) and L3(2) are not nested within L2, but are different estimators of the same stochastic process.

If it is assumed that e is distributed independently of u, L3(2) can be rewritten as

$$L4 = \pi_{-}1\text{-}pr(e \geq -\beta z_2)\pi_{+}pr(e \geq -\beta z_2)\pi_{+}g(y) \qquad (19)$$

The first two terms of L4 form a probit (or logit) model estimated using observations who have positive medical need, the dependent variable being 1 if claims/expenditure is positive and 0 otherwise. The third term is an OLS likelihood function in which the dependent variable is observed claims/expenditure, the function estimated using only those observations with positive claims.

If it is not possible to observe whether or not the demander has received primary care, model L3(1) and

L3(2) and model L4 cannot be estimated. In this case, as in Duan et al.(1982) and van de Ven and van Praag (1981), the observations can only be grouped into two. The first group contains those observations with zero expenditure and the second those observations with positive expenditure. As for the three part model presented above, different estimators can be derived under different assumptions about the stochastic process underlying the distribution of observed claims. Maintaining the assumption of a log-normal distribution of expenditure (as equation (12)) the likelihood function is given by

$$L5 = \pi_0 1\text{-}pr(w \geq -\beta z_2)\pi_1 pr(e \geq -\beta z_2)\pi_1 g(y \mid e \geq -\beta z_2) \qquad (20)$$

where 0 denotes those observations with zero expenditure and 1 those with positive expenditure. L5 differs from L3(2) because it is estimated using all observations. L5 is the ATM model. If the level of expenditure is assumed independent of the level of medical need, then L5 can be rewritten as

$$L6 = \pi_0 1\text{-}pr(e \geq -\beta z_2)\pi_1 pr(e \geq -\beta z_2)\pi_1 g(y) \qquad (21)$$

where the first two terms are estimated using all observations, and the third term estimated using only those observations with positive expenditure. A likelihood ratio (LR) test of L5 against L6 provides a test of the assumption of independence of e and u. Note

that is is not possible to derive estimates of the factors affecting the latent need for medical care separately from those determining referral by estimating L5 or L6, so that estimation of the ATM model (i.e. L5) is, in the UK situation, less efficient than estimation of models which incorporate sample separation. (For a discussion of the advantages of sample separation in estimation of labour supply functions, see Blundell et al.(1986) and in estimation of cigarette consumption, Jones (1987)).

Finally, although the likelihood function L6 has the same form as the Rand TPM (equation (3)), the interpretation of the two models is different. The aim of L5, and so of L6, is to model potential expenditure by the insured on health care. The aim of the TPM is to explain actual expenditure. If statistical tests permit the researcher to accept L6 as a valid simplification of L5, L6 still explains potential expenditure. If L6 can be accepted, it means that it is possible to estimate potential expenditure, using only those observations which have positive actual expenditure. In other words, the estimator of potential expenditure will be unbiased, even though only individuals with positive actual expenditure are used to estimate the parameters of the potential expenditure function. On the other hand, the OLS equation of the TPM (equation (5)) is used to estimate the parameters of actual expenditure. Actual expenditure depends on the institutional arrangements of the health care market. These determine whether a latent demand for

expenditure is realised.

Our primary aim is to estimate and test the three equation model specified in the likelihood functions L0 to L4. However, for comparative purposes we also estimate the ATM model, given by either L5 or L6. The nested structure is presented in Figure 5.1. L6 is nested within L5 and L4, L3(1), L3(2) and L1 are nested within L0, but L5 and L6 are not nested within L0, so that likelihood ratio tests cannot be used to test the ATM specification against the three equation model proposed here. However, comparison of parameters and other specification tests (such as score tests for normality) provide an informal test of the relative goodness of fit of the two models. Before turning to the estimation results, we first discuss our hypotheses of the determinants of each part of the claims process and review the data that has been used as measures of these factors.

3. THE DETERMINANTS OF HEALTH INSURANCE CLAIMS

In brief, we assume the claims process to have the following features. The decision to seek care is that of the demander; the decision to 'go private' is the outcome of negotiation between demander and supplier, based on information and advice provided by the supplier of care, and the level of private health care (once referred to the private sector) is the decision of the supplier, acting as the demander's (and perhaps his own) agent.

3.1 The decision to seek care

This is made by the insured person, perhaps in consultation with other family members. For any state of ill-health, the costs and benefits will primarily depend on health status, but work or income related factors may enter the decision and so may factors relating to the supply of medical facilities (e.g. accessibility of care providers).

3.2 Referral to the private sector.

The decision to refer to the private sector is ultimately made by the medical care provider (the GP), but patients can have input to this decision. There is considerable evidence that referral rates to the private sector differ substantially across GPs (Gillam 1985; Dowie 1983), partly as a function of the GP's information about public and private facilities, but also perhaps as a function of attitudes to risk (Dowie 1983) and attitudes to private care (Gillam 1985). In addition to these GP related factors, the probability of referral will obviously depend on the state of health of the demander. It is also likely to be affected by the insurance cover of the demander (for example, whether there are restrictions on cover for certain states of ill-health), although in general the scale of cover is not likely to affect the probability of referral as most contracts are designed to

provide full or near full cover. The probability of referral is also likely to depend on the relative availability of private and public sector facilities. For example, a lower supply of private sector facilities decreases the probability that a standard of treatment equivalent to that provided in the NHS can be provided locally in the private sector and this may increase the relative access costs of private insured care (relative to NHS care). Because of the geographical imbalance in the distribution of private sector facilities, the probability of referral is likely to be a function of location of the demander.

3.3. Level of expenditure once referred

We assume the level of medical care given to the sick person is exogenous to the demander and determined by the supplier acting in response to the medical condition of the demander, the insurance cover of the demander and perhaps also to supply side factors unrelated to the demander, such as the average occupancy rates of the hospital. It has also been argued that suppliers acting in a fee-for-service environment (such as the UK health insurance reimbursement system) have an incentive to persuade patients to accept more medical treatment than the patient would have demanded had he or she had full information. Obviously, the actions that would be taken under this counterfactual are very difficult to establish,

so that the existence and precise nature of 'supplier inducement' is presently a much debated and as yet unresolved issue (see for example, Parkin and Yule 1984). There is currently no direct evidence for or against inducement in the UK private sector. However, the reimbursement system used by insurance companies does not appear likely to constrain the activities of physicians to any great extent. Private hospitals and physicians are reimbursed by the insurance suppliers on a fee-for-service basis. Measures to contain costs per case are limited. Limits on the reimbursement provided within broad categories of surgical intervention are part of the insurance contract, and the contracts have limits on total claims. But these measures are crude in comparison to those employed in larger insurance based markets (e.g. USA) and the upper limit on total claims is well in excess of the average claim. In this situation, the level of care is likely to be determined by the physician, on the basis of medical need, but also acting in response to any supply constraints. If a supply constraint, such as the number of beds in a hospital, is binding, the incentive may be to treat patients as quickly as possible to maximize fee income. If this supply constraint is not binding, then at the margin, suppliers may encourage longer stays in hospital. Although not direct evidence of supply inducement, the comparison made by Williams et al. (1985a) between lengths of stay for common elective surgical procedures in NHS beds, NHS pays beds and private

hospital beds indicated that average lengths of stay in the private hospital beds were significantly higher than in NHS pay beds. This may be the result of a binding supply constraint for NHS pay beds and a non-binding constraint (the result of over-capacity) in the private sector. If suppliers do respond in this way to supply constraints we would expect factors relating to excess capacity of private facilities, such as the number of beds per capita in a district or region, to be determinants of costs and so of claims.

3.4 Data Sources for Model Estimation

The data for this research were drawn from four sources; the computerised records of the largest health insurance supplier in the UK, a postal questionnaire to a sample of those insured by this company and DHSS and private sector hospital statistics. None of these sources could provide very detailed data. The data on claims provided by the insurance company related to 1984 and the postal questionnaire was sent to subscribers in early 1986; the retrospective nature of the questionnaire thus limited the amount of detail that could be usefully collected. The insurance company could not break down costs to the level of the individual within a subscriber unit, nor provide any data on the charges of the private facilities used in a claim episode. The measures of the variables discussed in sections 3.1 to 3.3 were therefore

fairly broad but are similar to those used in the van de Ven and van Praag analysis. The data and sources are given in Table 5.1.

Table 5.1

Sources and Description of Variables Used in Analysis

1. INSURER FILES
(All variables for 1984)

Variable	Abbreviation	Type	Comments
Total claims in 1984	t-cost	c	
Age	age	c	(derived from date of birth)
Persons on registration	piir	c	
Scheme	scheme	d	B, C or U & S
Scale of cover	scale	d	missing for those with no claims
Any restriction on cover	restrict	d	missing for C, U & S subscribers
Live in south east	south east	d	derived from postcode
Region of treatment	reg	d	

2. QUESTIONNAIRE
(All variables except self-assessed health status variables are for 1984)

Variable	Abbreviation	Type	Comments
No.adults in subscriber unit	num adult	c	
No.children	num children	c	
Member's health rated as good	mhealth good	d	0/1 dummy variable
Member worrying about health	mworry	d	0/1 dummy variable
Chronic illness member	msick	d	0/1 dummy variable
Spouse's health	shealth good	d	0/1 dummy variable
Spouse worry about health	sworry	d	0/1 dummy variable
Chronic illness spouse	ssick	d	0/1 dummy variable
Worry about children's health	cworry	d	0/1 dummy variable
Gross household income	income	d	8 categories
Various measures of the utilisation of health services, public & private, by adults and children		d&c	

3. DHSS and INDEPENDENT HOSPITAL SECTOR
(All variables for 1984)

Variable	Abbreviation	Type	Comments
Wte NHS specialists in region	speccap	c	per 100 persons
Gps in region	GPcap	c	per 100 persons
Private beds in region	prbedcap	c	per 1000 persons
Mean waiting time in region	mwt	c	For all operative procedures

wte = whole time equivalent
d indicates qualitative variable, c indicates a continuous variable

From insurance company records we obtained data on claims and insurance cover in 1984 for 7000 subscribers. Two types of subscriber were sampled; subscribers with self-purchased cover and those with cover purchased by an employer, but the latter only for companies in which under 50 employees were covered. Sampling was proportional to the size of the two groups. A postal questionnaire was sent to all the sample, and the response rate was approximately 45 percent. After exclusion of subscribers with missing data on key variables, or living outside England, Scotland or Wales or making a claim outside the UK, the final sample size was 2893. Various checks for differences between respondents and non-respondents were made. The claims rate and level of claims of survey respondents were compared to the rates for non-respondents, but no significant differences were found. There were also no significant differences in terms of socio-economic characteristics or in mean level of claims between survey respondents excluded from the final sample on the basis of missing data and those included in the final sample.

Claims could not be allocated to any one particular individual in the subscriber unit without considerable error, so the chosen unit of analysis was the subscriber unit (an individual or family).

4. ESTIMATION RESULTS

Our procedure was to estimate the set of nested models discussed above, using log-likelihood ratio tests to select between models, and tests of normality and heteroscedasticity to test for misspecification of functional form. All models were estimated using the LIMDEP statistical package (Greene 1985).

Within the two broad types of subscribers in the sample, there are actually three groups of subscribers; subscribers with (small) company cover, subscribers with modern individual cover and a small group of subscribers who have an older type of individual cover. The first two groups have essentially the same policies; in fact purchasers in very small company cover groups (5 persons in the group) may, in demographic terms, closely resemble some self-employed individuals who purchase cover for themselves and their families. The policies of these two groups offer near full or full cover for permitted treatments, though the subscriber chooses the scale of cover. The lowest scale is designed to fully cover treatment in a small acute private hospital outside London, the highest scale to fully cover treatment in a hospital with the charges of a London teaching hospital. The policies of the third group (known as Unit and Standard subscribers) are quite different. These subscribers may choose their own level of cover and some of the policies chosen offer extremely little cover. As

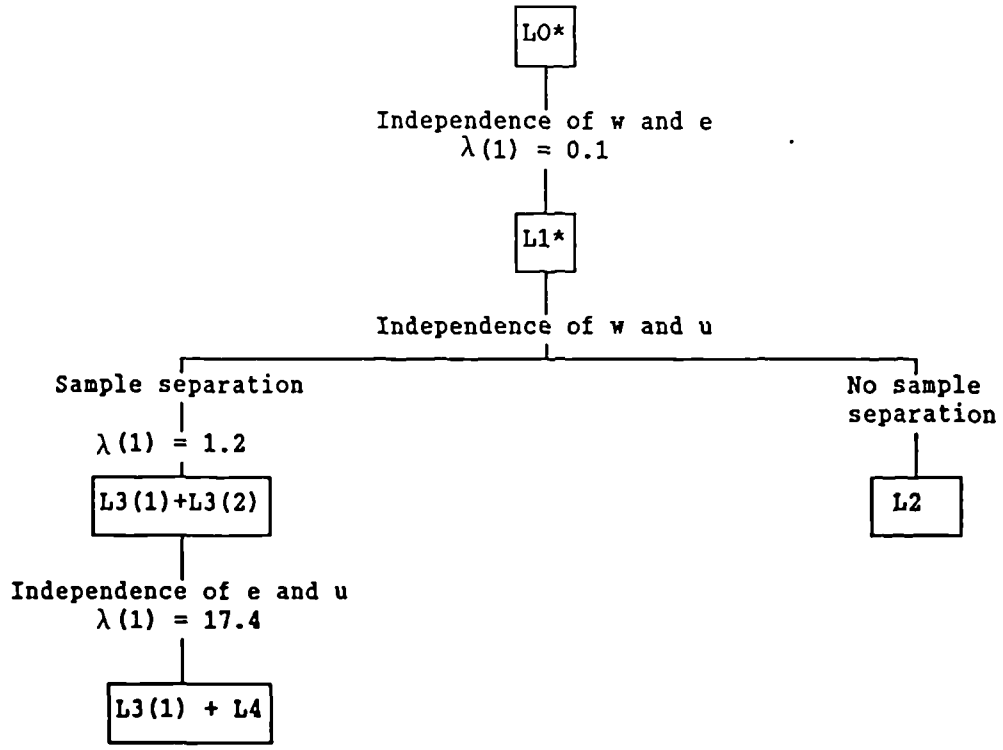
these policies have not been marketed since the mid 1970s and can only be purchased by those who have been in these schemes prior to the date of their withdrawal, the subscribers differ significantly in age (and claims rate) from other subscribers. Specification tests (reported below) indicated that inclusion of this group led to misspecification of functional form, specifically heteroscedasticity of the error term. Such heterogeneity in cross-sectional data is not uncommon and in circumstances where the source of misspecification can be identified, separate re-estimation for the different socio-economic groups can improve the efficiency of the model estimates (Blundell et al. 1986). The full set of nested models was therefore estimated excluding this group (278 subscriber units), although the final, preferred models were re-estimated including this group for comparative purposes.

The model structure is presented in Figure 5.1. The likelihood ratio tests for the nested structure are given on the lines linking the models. These tests indicate that we cannot reject the hypothesis of independence of the probability of requiring any medical care from the probability of making a claim (from the LR test of model L0 against model L1). Nor can we reject independence of the probability of requiring any medical treatment and the level of claims (from the LR test of

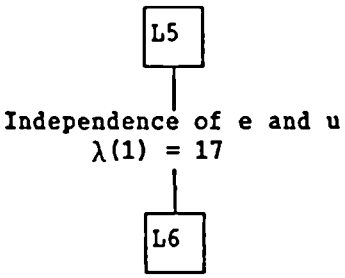
Fig. 5.1

Nesting of the estimated models and LR tests of model specification

(a) Three part model



(b) Adjusted Tobit Model



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* The claims equations for these models estimated by a Heckman two step estimator for a bivariate probit model with sample selection

Assumptions on stochastic process given on lines joining models.

$\lambda(r) = 2[\text{LogL}_u - \text{LogL}_r]$, LogL_u = unrestricted loglikelihood,

LogL_r = restricted loglikelihood, r = number of restrictions

model L1 against model L3(1) and L3(2)). However, we can reject the hypothesis of no sample selection (equivalently, independence of the probability of making a claim and the level of that claim) (from the LR test of L3(1) and L3(2) against L3(1) and L4).

These results indicate that the probability of requiring any care can be estimated as an independent probit equation, using all observations in the sample, and the probability of making a claim and the level of that claim can be estimated by a model that allows for sample selection, using only those observations with positive medical care. The parameter estimates for this model (equations L3(1) and L3(2)) are presented in Table 5.2 together with diagnostic tests of misspecification. The test for normality used is that proposed by Bera, Jarque and Lee (1984), the test for heteroscedasticity that proposed by Davidson and MacKinnon (1984) (also used in Chapter 4). The tests for normality indicate that the error terms in both the probability of any medical need or the probability of making a claim equation would appear to be distributed normally. However, the specification tests for heteroscedasticity indicate misspecification due to income and age in the medical need decision equation.

To remove these sources of misspecification it may be necessary to estimate this equation separately for different age/sex groups (or equivalently, and perhaps more powerfully, include interactions between the health

Table 5.2

Models L3(1) and L3(2)

	Coefficient	Standard error	t-ratio
(a) Medical need [Model L3(1)] (n = 2212)			
intercept	1.262	0.365	3.45
numadult	0.643	0.132	4.87
numchild	0.167	0.004	3.85
mhealthgood	-0.311	0.102	-3.05
mworry	-0.179	0.087	-2.05
msick	0.521	0.121	4.30
shealthgood	-0.157	0.126	-1.24
sworry	-0.265	0.116	-2.28
ssick	0.351	0.159	2.20
age	-0.052	0.015	-3.48
age2	0.0005	0.00015	3.68
income	0.019	0.021	0.89
Loglikelihood	- 785		
Normality	1.186 (5.99)		
Heteroscedasticity			
income	92.6 (3.84)		
age, age2	94.3 (5.99)		
(b) Referral [Model L3(2)] (n = 1912)			
intercept	-0.598	0.312	-1.91
numadult	0.073	0.106	0.69
numchild	0.029	0.039	0.76
mhealthgood	-0.212	0.074	-2.89
msick	0.297	0.081	3.69
shealthgood	-0.082	0.083	-0.99
ssick	0.199	0.093	2.11
age	-0.025	0.013	-2.08
age2	0.00037	0.0001	3.02
income	0.051	0.017	2.89
piir	0.133	0.039	3.35
company scheme	0.209	0.071	2.95
prbedcap	0.004	0.002	1.51
Normality	0.55 (3.84)		
Heteroscedasticity			
income	7.64 (3.84)		
age, age2	7.193 (5.99)		

... continued ...

Table 5.2 ... continued ...

	Coefficient	Standard error	t-ratio
(c) level of claims			
intercept	4.802	0.4119	11.659
adult outpat nhs	0.127	0.047	2.697
adult outpat priv	0.096	0.025	3.872
adult inpat stays	0.277	0.120	2.31
tsnhsd	-0.443	0.273	-1.62
tsprivd	1.406	0.175	8.203
child outpat nhs	0.03	0.074	0.411
child outpat priv	0.048	0.050	0.96
child inpat nhs	0.011	0.167	0.067
child inpat priv	0.589	0.127	4.26
numadult	-0.216	0.1146	-1.884
numchild	-0.056	0.045	-1.237
prbedcap	0.00437	0.0039	1.11
income	0.0091	0.024	0.38
company cover	0.287	0.097	2.96
scale	-0.0398	0.083	-0.466
σ	1.157	0.032	35.791
Loglikelihood	2496.2		

critical x^2 values given in brackets next to score tests

variable names
numadults: number adults in family
numchild: number children in family
mhealthgood: good health member
shealthgood: good health spouse
mworry: member hardly ever worry about health
msick: member has chronic illness
ssick: spouse has chronic illness
age: age of member
age2 = age x age, where age = age of oldest member of subscriber unit
income (categorical variable)
piir: number of persons covered by policy
company scheme: company purchased policy
prbedcap: private beds per capita x 1000 in region
adult output nhs: number of adult outpatient visits nhs
adult output priv: total number of adult outpatient visits private
tsnhsd: dummy variable with value 1 if any inpatient stays (adult) in nhs
tsprivd: dummy variable with value 1 if any inpatient (adult) stays in private sector
scale: scale of cover provided by policy (1 = highest, 3 = lowest).

variables and age/sex dummies as part of the set of regressors). This first equation is essentially a single equation model of the demand for health care. When estimating such a model using a larger data set from the General Household Survey, Winter (1987) found evidence of misspecification when estimating a single model for all age/sex groups. Further, he found that estimation of the same model for different age/sex groups separately resulted in a significant fall in misspecification. As our interest is primarily to estimate the factors that affect private insurance claims, rather than to estimate the demand for any medical care, and the LR tests indicate independence of the medical need equation from the claims equations, we did not seek to further model the first equation. Tests for misspecification of the probability of making a claim equation show that heteroscedasticity in income and age does not appear to be a large problem in this second equation. Thus the parameter estimates for this equation would appear to be reasonably consistent.

We turn now to a discussion of the parameter estimates of the estimated model (Table 5.2). To facilitate the estimation we omitted, in all three equations, variables with coefficient estimates that were small in absolute value, poorly defined, which did not covary with those of other coefficients and which did not significantly affect the goodness of fit of the model. Loglikelihood ratio tests indicated that omission of these regressors did not significantly reduce the explanatory

power of the model.

4.1 The determinants of medical need

Approximately 85 percent of subscriber units had some positive contact with a supplier of medical care in the survey year. As might be expected, this decision appears to be associated primarily with measures of health status. From the first part of Table 5.2 it can be seen that self rating of health as good and worry about health as low by both head and (where present) spouse is negatively associated with the probability of needing medical care. Either the head or the spouse having a long term chronic condition is positively associated with the probability of positive medical care. The relationship between age and need for care appears to be non-linear. The coefficient on age (measured in years) is negative, the coefficient on age2 is positive. The coefficient on the income terms is small and not significantly different from zero. Thus the probability of requiring medical need does not appear to be strongly or significantly associated with income. This perhaps might be expected, given that the sample of individuals is primarily drawn from higher income groups (see the results of Chapter 4) and that preliminary contact in the health care system is with the zero money cost NHS. Neither supply side variables nor features of the insurance contract appear to be significantly associated with the probability of having

any contact (estimates presented in Table 5.2 exclude these variables). Again, given the limited nature of the insurance cover, the latter result is unsurprising.

4.2 The probability of making a claim in the survey year

It was hypothesised that the probability of making a claim would be associated with both demand and supply factors. This hypothesis appears to be supported from the results presented in the second part of Table 5.2. The signs of the health status measures are of the expected direction. Those who rate themselves as in poorer health or are in poorer health as measured by chronic illness are more likely to make a claim. Even controlling for health status (as measured in the data set), age of the demander appears to be significantly associated with the probability of making a claim, though again the effect is non-linear. Interestingly, income is significantly and positively associated with the probability of making a claim, though the coefficient is not large.

As expected, the probability of making a claim is significantly associated with features of the insurance contract. The results show, as might be expected, that the more persons covered by this insurance contract the more likely it is that the subscriber unit will make a claim. But the results also show that those subscribers with company cover are significantly more likely to make a

claim. The reason for this difference in probability of making a claim between company covered and self-covered individuals with similar insurance policies is not clear. It may occur because self-covered individuals think that they may face restrictions on their cover in future years as a result of current claims, whilst those covered by their company do not expect (or even have knowledge of) the use of restrictions. It may be the case that individuals covered by corporate cover are of higher risk (or rather, of higher risk in terms of the type of cover provided by health insurance). As perhaps some evidence of this difference in risk, the claims rate rose in the late 1970s/early 1980s as the private health insurance companies extended their sales to the corporate sector. For the three leading provident associations (BUPA, PPP, WPA) benefits paid out as a proportion of subscriptions rose sharply from an average of about 70% in the years 1977-1979 to 95% in 1981. This ratio in 1984 was 82% which is close to the long term average (Laing (1987)). It was thought that this sharp rise might have been due to the higher than expected claims rate of the dependents of the employer covered individuals. As we could not identify the source of a claim within a subscriber unit we could not use our data to further explore this hypothesis, but differences in risk might be one explanation for the higher claims rate of subscriber units with corporate cover.

Finally, we hypothesised that the claims rate

might be affected by the relative availability of private and public health care facilities. The model indicates a positive association, significant at the 10 percent level, between the number of specialists per capita in the health region and the probability of having a positive claim. Unfortunately, the geographical imbalance in the distribution of private sector facilities means that it is not possible to separate the effect of private sector availability from any other factors which are also geographically unevenly distributed and are not measured in the data (for example wealth).

4.3 The level of claims (conditional on a claim being made)

From the results presented in the third part of Table 5.2 the principal correlates of the level of claims appear to be the extent of utilisation of the private sector by both adults and children in the household, and, to a smaller extent, the utilisation of NHS facilities by adults, and the source of purchase of the insurance.

Measures of utilisation of medical care reflect health status, but measures of private sector utilisation are also, by definition, one component of expenditure. To avoid the problem of regressors simply being definitionally associated with the regressand (rather than being determinants of the regressand), two dummy variables were created, the first with value one if any inpatient

stays were in the private sector, the second with value one if any inpatient stays were in the public sector. These were used as regressors together with continuous variables measuring the total number of inpatient stays and out-patient visits. Children's and adults' stays and visits were treated as separate variables.

The results indicate that subscriber units with higher use of the private sector have higher claims. The positive signs of the coefficients measuring private utilisation were expected. However, it is interesting to note that NHS inpatient utilisation is also positively and significantly associated with the level of claims. Adult NHS out-patient utilisation/visits to specialists is also positively associated with the leel of claims, though the coefficient is not well determined. The negative coefficient of the NHS inpatient stay dummy variable does not indicate that NHS utilisation is negatively associated with claims; rather, it indicates that those with inpatient stays have lower claims if the stay has been in the NHS rather than the private sector. The positive association between measures of NHS utilisation and claims suggests that private sector utilisation may be co-temporaneous with the use of NHS secondary care. We cannot know from the analysis whether this is because patients move from NHS secondary care to private sector secondary care or vice versa. It is also interesting that utilisation by children of the NHS is not associated with the level of claims. Perhaps adults are prepared to move

between sectors for their care, but do not move children. It may also be the case that the nature of a child's health care episode is different from an adult's episode. Such differences cannot be easily inferred from the data here.

There appears to be no significant association between self-assessed health status, having a chronic illness, age or income and the level of claims. The last result is interesting, given the association between income and the probability of making a claim. The negative (but poorly defined) coefficient on presence of a second adult in the household may indicate that those subscribers who do not live on their own have a shorter duration of treatment, perhaps because there are individuals in the home who can provide substitutes for the nursing care provided in hospital.

The association between scale of cover and level of claims is in the expected direction, indicating that those with higher scale cover have higher claims, but perhaps surprisingly, the parameter estimate is small and not well-defined. This lack of association might occur because the different scales really only apply to the inpatient stay component of a claim, so that the costs of all other parts of a claims are similar across different scales of cover. The data was such that we could not further investigate this. It is interesting that company cover is associated with higher levels of claims, as well as a higher probability of making a claim. Finally, there

would appear to be no significant association between the number of private facilities in a region (and so perhaps average occupancy rates) and the level of claims. If the cost of stay is related to supply side factors the measure used in the present analysis are too crude capture this effect.

4.4 Re-estimation including Unit and Standard subscribers

The probability of having any medical care and the probability of having a claim equations were re-estimated including observations with Unit and Standard subscriptions (these subscribers having been omitted from the earlier analysis on ground of the lower coverage of their policies. Estimation was carried out under the hypothesis of independence of the two decisions. The same equations were also estimated using only Unit and Standard observations. The results are presented in Table 5.3.

A comparison of the estimates of the probability of having any medical care derived with and without this group of observations (the first equations of Tables 5.3 and 5.2 respectively) indicates that the coefficients are of similar sign and magnitude. A comparison of the score statistics for misspecification indicates misspecification in this equation whether estimated with or without the U and S subscribers. A loglikelihood ratio test indicates that inclusion of the U and S subscribers

Table 5.3
Estimation including unit and standard subscribers

	All observations including U & S		U & S only	
	coefficient	standard error	coefficient	standard error
a) medical need				
intercept	0.927	0.33	2.85	2.11
numadult	0.664	0.12	0.72	0.33
numchild	0.111	0.039	-0.18	0.11
mhealthgood	-0.293	0.093	-0.24	0.25
mworry	-0.191	0.081	-0.189	0.25
msick	0.486	0.105	0.47	0.23
shealthgood	-0.117	0.117	0.23	0.36
sworry	-0.251	0.109	-0.23	0.36
ssick	0.334	0.144	0.23	0.37
age	-0.032	0.013	-0.077	0.068
age2	-0.00031	0.00013	0.0005	0.0005
income	0.0065	0.019	-0.11	0.057
loglikelihood	-914.4		-114.61	
normality	4.49 (5.99)		10.29 (5.99)	
heteroscedasticity				
income	84.06 (3.84)		3.52 (3.84)	
age, age2	87.9 (5.99)		4.569 (5.99)	
n	2490		278	
b) probability of claims				
intercept	-0.59	0.312		
numadult	-0.073	0.1055		
numchild	0.029	0.039		
mhealthgood	-0.21	0.073		
msick	0.29	0.080		
shealthgood	-0.08	0.083		
ssick	0.199	0.095		
age	-0.0025	0.012		
age2	0.00036	0.0001		
income	0.059	0.018		
piir	0.133	0.04		
sch1	0.281	0.07		
sch2	-5.08	13.74		
prbedcap	0.0039	0.0026		
loglikelihood	-1233.9			
normality	37.54 (5.99)			
heteroscedasticity				
income	190.5 (3.84)			
age, age2	190.9 (5.99)			
n	2139			

... continued ...

Table 5.3 ... continued ...

critical x^2 values given in brackets next to score tests

variable names
numadults: number adults in family
numchild: number children in family
mhealthgood: good health member
shealthgood: good health spouse
mworry: hardly ever worry about health, member
msick: member has chronic illness
ssick: spouse has chronic illness
age: age of member
age2 = age x age
income (categorical variable)
piir: number of persons covered by policy
company scheme: company purchased policy
prbedcap: private beds per capita x1000 in region
adult output nhs: number of adult outpatient visits nhs
adult output priv: total number of adult outpatient visits private
tsnhsd: dummy variable with value 1 if any inpatient stays (adult) in nhs
tsprivd: dummy variable with value 1 if any inpatient (adult) stays in private sector
scale: scale of cover provided by policy (1 = highest, 3 = lowest).

does not significantly improve the goodness-of-fit of this equation. The parameter estimates of this equation for the U and S subscribers only are poorly defined. This is not surprising given the small size of sample.

To estimate the probability of making any claim using all observations the dummy variable for company cover was replaced by two variables. The first was positive if the subscriber unit had company cover, the second positive if the subscriber had a U and S subscription. (These dummies are variables sch1 and sch2 respectively). The parameter estimates of this equation estimated with all subscribers are virtually identical to those of the model estimated without the U and S subscribers. The parameter estimate of the dummy variable for U and S subscription is very large and negative, though poorly defined. The sign and size were expected given the zero claims of the latter group. However, inspection of the score tests for misspecification for this equation, given in Table 5.3, indicates that inclusion of the U and S group significantly increases model misspecification. For this reason, observations with U and S subscriptions were omitted from the main analysis.

4.5 Comparison with ATM specification

The difference between the ATM specification and the three part model presented above is that the ATM does

not distinguish between the probability of having positive medical need and the probability of having a claim. Therefore, under the ATM, the probability of having a positive claim is estimated using all observations in the sample. For the three part model the parameters of this likelihood are estimated using only those observations with positive medical need. However, as only 15 percent of the sample did not have medical need, we would perhaps not expect the parameter estimates for the ATM to be very different from the parameter estimates of the second two equations of the 3 part model discussed above.

Estimates of the ATM model are presented in Table 5.4. The loglikelihood ratio test for the Sample Selection Model against an independent probit and OLS specification of the ATM rejects the latter specification, although, as in the van de Ven and van Praag analysis, the estimated correlation coefficient between the error terms of the two equations is not significant. (Van de Ven and van Praag did not carry out the LR test for independence). The parameter estimates for the probability of making a positive claim are similar in both the ATM and our 3 part model when both models are estimated without the U and S subscribers. The specification tests indicate heteroscedasticity is a problem for the probit equation of the ATM model. Heteroscedasticity is a problem in the first probit equation of our proposed three equation model, but not in the second (which corresponds to the only probit equation

Table 5.4

Adjusted Tobit Model

	Coefficient	Standard error	t-ratio
(a) probability of any claims (n = 2212)			
intercept	-0.728	0.297	-2.45
numadult	0.169	0.101	1.681
numchild	0.054	0.037	1.488
mhealth	-0.267	0.0705	-3.788
msick	0.369	0.077	4.769
shealth	-0.11	0.0807	-1.369
ssick	0.246	0.092	2.66
age	-0.033	0.116	-2.85
age2	0.00044	0.00011	3.83
income	0.05	0.016	3.01
piir	0.137	0.038	3.55
company cover	0.206	0.067	3.06
prbedcap	0.0047	0.0025	1.89
Normality	2.19 (5.99)		
Heteroscedasticity			
income	21.3 (3.84)		
age, age2	21.4 (5.99)		
(b) level of claims (n = 813)			
intercept	4.808	0.39	12.15
adult outpat nhs	0.127	0.044	2.88
adult outpat priv	0.095	0.024	3.916
total inpat stays	0.277	0.123	2.24
tsnhsd	-0.44	0.25	-1.79
tsprivd	0.41	0.17	8.27
child outpat nhs	0.304	0.073	0.412
child outpat priv	0.048	0.046	1.028
child inpat nhs	0.011	0.12	0.091
child inpat priv	0.589	0.157	3.736
numadult	-0.212	0.116	-1.906
numchild	-0.056	0.043	-1.26
prbedcap	0.0043	0.0038	1.136
income	0.085	0.024	0.35
company cover	0.284	0.097	2.93
scale	-0.039	0.08	-0.485
σ	1.13	0.031	36.75
$\rho(1,2)$	0.0686	0.158	0.432
Loglikelihood	-2610		

Table 5.4 ... continued ...

critical x^2 values given in brackets next to score tests

variable names
numadults: number adults in family
numchild: number children in family
mhealthgood: good health member
shealthgood: good health spouse
mworry: hardly ever worry about health, member
msick: member has chronic illness
ssick: spouse has chronic illness
age: age of member
age2 = age x age
income (categorical variable)
piir: number of persons covered by policy
company scheme: company purchased policy
prbedcap: private beds per capita x1000 in region
adult output nhs: number of adult outpatient visits nhs
adult output priv: total number of adult outpatient visits private
tsnhsd: dummy variable with value 1 if any inpatient stays (adult) in nhs
tsprivd: dummy variable with value 1 if any inpatient (adult) stays in private sector
scale: scale of cover provided by policy (1 = highest, 3 = lowest).

of the ATM). As the three equation model and the ATM are not nested, we cannot test the appropriateness of the two models using LR tests. However, the collapse of two different decisions into one equation in the ATM, the resulting loss of information and the test results indicating misspecification of functional form of the probability of claims equation all suggest that on both theoretical and empirical grounds our three part model is more appropriate for the UK market.

CONCLUSIONS

The estimation results indicate that the level of claims/expenditure in the UK private health insurance market can be modelled as a three equation process, with independence of the first equation and weak dependence of the second and third. The analysis supports the hypothesis that the three different processes are associated with different (though overlapping) sets of variables. Parameter estimates give some support to prior hypotheses. Health status appears to be a significant determinant of the probability of having any medical care, health insurance and financial status appear to be determinants of the probability of having a claim and the level of claims appears dependent upon utilisation of the NHS, proxies for health status, and the extent of utilisation of the private sector. Further, tests suggest that the three part model is more appropriate in the UK

context than the ATM model.

Further investigation is required to examine the effect of supply-side factors on the claims process. Although the coefficients on supply side variables were of the expected sign, none of these were well determined. It may be the case that the variables used were too crude a measure of the supply side factors which affect claims, but it may also be the case that the demander is an inappropriate unit of analysis for an investigation of the impact of supply side factors on claims. An alternative approach would be to select a sample of suppliers (private sector hospitals) and to examine the relationship between claims and characteristics of the suppliers (for example occupancy rates, organizational aims, market position).

More research is also required to investigate the relationship between the type of cover provided and claims or expenditure. The current analysis has indicated that there are significant differences in claims rate between the three groups of subscribers in the sample. The lower claims rate of the United and Standard subscribers can be explained by the limited cover provided by these contracts. But the difference between individual and company purchase cannot be explained by differences in cover. The two latter groups have essentially the same policies, although the cost for corporate subscribers is lower (or zero). We have offered reasons for this difference in the discussion above; it would seem a subject worth investigating in greater depth. Finally,

because of missing data, we were not able to fully investigate the effect on the probability of making a claim or on the level of claims of restrictions on the insurance cover. For individual purchasers with full cover, having one or more restrictions did not appear to be significantly associated with either the probability of making a claim or the level of claims. However, without better data it is not possible to know whether this result is specific to this group, is due to the small size of the sample, or is applicable to all subscriber groups.

CHAPTER 6

ESTIMATION OF THE VALUE OF WAITING TIME

One of the recurrent themes of this thesis is the effect of time costs on the choice between public and private health care. However, there is little published data on the cost of time spent in receipt of, or waiting for, health care. In our simulation of the model of Chapter 2, we had to rely on values based on hourly wages; in our econometric estimation of the same model, we used proxies for the value of time. As we noted in the discussion of the estimation results, the use of proxies is not a desirable approach. In the present chapter, we seek to remedy, in part, this lack of data. We present research designed to provide estimates of the monetary value of the disutility of time spent on waiting lists for non-urgent medical treatment in the NHS (hereafter referred to as 'waiting list time'). The aim was to derive these estimates from trade-offs made by demanders between waiting time and money. The nature of the health system meant that these trade-offs could not be observed with sufficient precision to permit estimation from revealed preference data, so instead we used data derived from stated intentions.

The organization of the chapter is as follows. We

begin with a discussion of the different types of cost that may be associated with the use of waiting lists in the NHS. In the second section we review the theories of time proposed in economics, outline an extension to these theories which permits estimation of the value of time using discrete choice data and discuss the applicability of these approaches to our aim of estimation of the value of waiting list time. We end this section with a discussion of the data requirements for an estimation of the value of waiting list time. This involves examining those data which are currently available and outlining the relative merits of data based on stated intentions and data based on observed actions. In the third section we look in more detail at the issues that have arisen in the collection of 'intentions' data for the current study. The issues include the choice of type of question, the choice of a context within which respondents are asked to make choices and the choice of population from which to draw respondents. In section 4 we present the precise specification of the econometric model which was used to derive estimates of the money value of a unit of waiting list time. The estimates from this model are discussed in section 5. We conclude with a brief discussion of issues which would have to be considered in any application of the methodology or the study findings.

1. THE COSTS OF NHS WAITING LISTS

As we noted in the introductory chapter to this thesis, it is widely recognised that time has an important role in the allocation of medical care, particularly, but not exclusively, in health care systems in which allocation by money price is relatively unimportant. Various aspects of this 'generalized cost' of medical care have been studied, and recently attention has been drawn to the specific role and costs of waiting lists (Lindsay and Feigenbaum 1984; Cullis and Jones 1985, 1986; Iversen 1987). As outlined in Chapter 1, Lindsay and Feigenbaum (LF) have argued that the costs associated with waiting per se are zero; the costs of a waiting list arise from the effect of delay in receipt of treatment on the value of the medical care. We considered a number of arguments against this assumption in Chapter 1; in this chapter we wish to consider in more detail the types of cost that may be associated with waiting lists.

It is useful to separate out the costs (and the concomitant disutility) which arise from treatment from those which arise from the wait itself. The first category corresponds to the type of costs enveloped into the LF 'decay rate'. Such costs include, presumably, the impact of a wait on the difficulty of treatment and the attendant risks of medical complications, the pain and discomfort associated with treatment and the effect of a wait on the efficacy of treatment, as measured by future health

status. In the LF analysis, decay in patient health is seen as a factor which makes the eventual treatment worth less, but it is unclear whether the costs of time spent in ever poorer states of health whilst waiting is a component of the decay rate. However, it is clear that in the LF framework there are no costs associated with waiting for treatment for a disease with zero deterioration over the period of wait other than those induced by a positive rate of time preference. But it would seem that there are other costs which arise from waiting per se. First, depending on the state of ill-health, the person waiting for care may be restricted in his or her ability to perform work and/or leisure activities. This may have direct financial consequences, but even if there is no financial cost, may be a source of disutility. Second, the wait may be associated with anxiety over both the nature of treatment and the outcome. The longer the wait, the longer the waiter will have these anxieties. Third, if the length of wait is not known at the outset, there may be disutility associated with the uncertainty of date of treatment. Finally, a wait may result in costs for individuals associated with the person on the waiting list. For example, the costs of providing care for the sick person, or loss of income for those dependent on the sick person for financial support or the costs of living with an anxious person.

The aim of the present analysis is to estimate the monetary value of the disutility that may result from this

second category of costs, i.e. those which arise from the wait itself. Specifically, we wish to derive from demanders the monetary value of the disutility (to themselves) of a unit increase in the length of wait for an illness with zero decay rate. The advantage of a monetary figure is that is can be used in analyses in which the unit of measurement is money or income. For example, it can be used to derive an estimate of the total costs of waiting lists for demanders, or as an input to social cost benefit analysis. (The use of a monetary figure based on private calculus in social costs benefit analysis is discussed at the end of this chapter).

To date, there has been only one estimate of the costs of NHS waiting lists and this used the LF framework (Cullis and Jones 1986). The authors argued that the maximum cost to consumers of waiting is the price of private sector care (for the treatment for which the consumer is waiting) and the minimum cost is zero. Their argument is as follows. For the marginal joiner, the benefits of joining the lists are equal to the (fixed) cost of joining i.e. the wait dissipates all benefits of treatment above the cost of joining the queue. If the benefits of treatment are marginally lower, the individual will not join the list, but instead would seek private treatment. The maximum cost of being on the list is therefore the price of private treatment. Specification of the minimum cost as zero hinges on the assumption that waiting per se imposes no costs. Using this argument,

they calculate the total annual costs of waiting lists to be equal to the number of waiters multiplied by the mean wait multiplied by half the average cost of private sector treatment. (The distribution of costs across waiters is assumed uniform, with a maximum of the price of private sector care and a minimum of zero. Therefore the mean cost is 0.5 times the average private sector cost). Using this approach they derive an estimate of the cost of waiting lists of between 9.1 and 16.2 percent of the NHS total budget.

The aim of this research is to derive estimates of the value of time spent on waiting lists from trade-offs made by individuals between waiting list time and cost. These values can be used to derive estimates of the costs of waiting lists by multiplying the estimate of the average value of waiting list time by the average wait.

2. MEASURING THE VALUE OF WAITING TIME

To estimate a monetary value of the disutility of waiting list time three separate strands of research have to be brought together. First we have to establish the economic basis for measures of the value of time. Second, the model used has to have properties which permit empirical estimation in the health care context which leads to the formulation of the model in terms of the 'random utility' theory of discrete choice. Third, we have to consider the statistical requirements for the

estimation of the model.

2.1 Micro-economic theory of the value of time

We do not intend to review the general discussion of time allocation within a utility framework in any detail, but rather wish to use some of the ideas in this literature to discuss the nature of waiting list time and how the disutility of waiting time may be estimated. In an early discussion of the economics of time, Becker (1965) proposed that the standard direct utility function of the consumer, with commodities as the arguments, be respecified in terms of activities, each of which has a certain requirement in terms of both commodities and time. Consumers face a total time constraint of 24 hours per day, so time enters the indirect utility function, but is not an argument of the direct utility function. Models more recently proposed in transport economics (e.g. Truong and Hensher (1985)) follow de Serpa (1971) who modelled time as an argument of the direct utility function as well as a constraint on utility maximization.

De Serpa (1971) assumed that direct utility is derived from a vector of commodities, plus a vector of time spent in various activities (the effect on utility of the components of the time vector can be either negative or positive). The individual maximises utility subject to a set of constraints. First, there are budget constraints on income and the total amount of time. Second, de Serpa

introduces the idea of a 'technologically' fixed amount of time required for the consumption of each commodity. Formally, the model is as follows (we follow MVA et al. (1987) in our outline):

$$\max_{\underline{x},\underline{t}} U = U(x_1,\ldots,x_m,t_1,\ldots,t_n) \tag{1}$$

subject to

$$w.t_w + y \geq \underline{p}.\underline{x}$$

$$T \geq \Sigma_j t_j + t_w$$

$$t_j \geq t_j^*$$

$$t_w \geq t_w^*$$

where

$\underline{x}$ = vector of goods,

t_j = unit of time spent in activity j, j = 1,...,J,

t_w = time spent at work,

$\underline{p}$ = price of goods,

t_j^* = technologically defined minimum amount of time spent in activity j,

y = income

The Lagrangean is given by

$$L = U(\underline{x},\underline{t}) + \lambda(w.t_w + y - p.x) + \mu(T - \Sigma t_j - t_w) + \phi(t_w - t_w^*) + \Sigma\, \psi_j(t_j - t_j^*) \tag{2}$$

and differentiating with respect to x, t and t_w we get

$$\delta U/\delta x_j - \lambda p_j = 0$$
$$\delta U/\delta t_j - \mu + \psi_j = 0$$
$$\delta U/\delta t_w - \mu + \lambda w + \phi = 0$$

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

$$(\delta U/\delta t_j)/\lambda = \mu/\lambda - \psi_j/\lambda \qquad (3)$$

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

In transport economics, interest has focused upon the value of reduction of time spent on transit mode j. From equation (3) this is given by

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

There has been some discussion as to whether it is possible to distinguish between the two separate

components that make up the value of time saved in activity j (Bates 1987; Truong and Hensher 1987). In this analysis we follow Bates in arguing that the resource value of time (the value of pure leisure) and the marginal valuation of time spent in activity j are theoretical constructs that can not be separated in empirical estimation. In estimation, the analyst can only derive estimates of the value of reducing time spent in activity j. For activities which give disutility, the marginal valuation of time will be negative, so the value of time saved will be greater than the resource value of leisure time.

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

2.2 Extension to discrete choice

Truong and Hensher (1985) (hereafter TH) extended the de Serpa analysis to situations of discrete choice. The consumer's problem is given by

$$\max U'(G,q,t_1,\ldots,t_n) \tag{4}$$

subject to

$$y \geq pG + \Sigma_j d_j c_j \tag{5}$$

$$T \geq q + \Sigma d_j t_j \tag{6}$$

$$t_j \geq t_j^* \tag{7}$$

where G is the quantity of a generalized consumption good, q is time spent in a 'generalized' activity (including work) and t_j and c_j are the time and money costs of the alternatives, $j = 1,\ldots,J$ and the d_j are dummies indicating which choice is made, such that $d_j = 1$ if choice j is made and 0 otherwise. The Lagrangean is given as

$$L = U'(G,q,t_1,\ldots,t_n) + \lambda(y - pG - \Sigma d_j c_j) + \mu(T - q - \Sigma d_j t_j) + \Sigma_j \psi_j d_j (t_j - t_j^*)$$

and the first order conditions as

$$\delta U'/\delta x = \lambda p \tag{8}$$

$$\delta U'/\delta q = \mu \tag{9}$$

$$\delta U'/\delta t_j = d_j \mu - d_j \psi_j \tag{10}$$

From equations (4) to (10) a conditional direct utility function can be derived using a first order approximation to the direct utility function and substituting in the first order conditions and the total income and time budget constraints. An indirect utility function is specified because it is assumed that when a consumer chooses between alternatives only the best of an alternative is compared to the best of another alternative. This indirect utility function is given by

$$U' = a + \lambda(y - c_j) + \mu T - \psi_j t_j \qquad (11)$$

Once the indirect utility function is defined, a probabilistic choice model can be formulated to permit estimation. Following the economics of transport literature, we adopted the random utility model (McFadden 1974). In this model it is assumed that the (indirect) utility of individual i of option j can be specified as

$$U_{ij} = V_{ij} + e_{ij}$$

where V_{ij} is a deterministic component and e_{ij} a random error, assumed uncorrelated with V_{ij}. The stochastic specification of U_{ij} means that is is possible to speak of the probability that alternative j is chosen, as a function of the relative values of V_{ij} (j = 1,...,J) and the assumed distribution of the stochastic term.

Specifically, the probability that alternative j is chosen rather than any other alternative, say j', can be expressed as

$$P_{ij} = Pr[(V_{ij} + e_{ij}) > (V_{ij'} + e_{ij'})] \quad .$$

The assumptions made about the distribution of the error term determine the type of model to be estimated. In the case of choice between two alternatives, two distributions are commonly used. The errors are specified as i.i.d. with either a normal or Weibull distribution. Using the first assumption the binomial probit model can be derived, using the second, the binomial logit model.

It is generally assumed, though not necessary for estimation, that V_{ij} is a linear function of the attributes of alternative j and choice-maker i, i.e.

$$V_{ij} = x_{ij}'\underline{\beta}$$

where x_{ij} = are the attributes of choice j as perceived by choice maker i

$\underline{\beta}$ = vector of weights, fixed across individuals

We assume that the deterministic component of utility of each choice can be specified as equation (11) i.e. for individual i and choice j, $V_{ij} = U'$, where U' is as in (11). When making a choice between two alternatives, terms common to both alternatives are irrelevant and can be omitted. Therefore, at its

simplest, the deterministic element of the random utility formulation of the problem given in equations (4) to (11) is given by

$$V_j = - \lambda c_j - \psi_j t_j \qquad (12)$$

where c_j and t_j are the cost and time attributes of activity j respectively. As in the continuous model, the ratio of the time and cost coefficients can be interpreted as the value of the utility of saving time in activity j.

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

$$V_j = -\lambda c_j - \psi_j t_j \qquad (13)$$

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

The Becker and de Serpa analyses and extensions

thereto all assume that the uses of time are mutually exclusive. These models do not address the question of non-exclusive uses of time. Waiting for care on a waiting list is a non-exclusive use of time. However, as an individual on a waiting list for medical care is in a state of health that is less good than his normal state, being on a waiting list does have an effect on the individual's allocation of time. Being ill may both decrease the utility of some uses of time and/or actually prevent the individual from undertaking some of his normal uses of time at all. Using the de Serpa framework, the effect of being on a waiting list can be modelled as both decreasing the utility of time spent in any activity and increasing the number of technological constraints that are binding. Thus the de Serpa framework can be extended to incorporate non-exclusive uses of time. Thus, while being on a waiting list is not directly analogous to that of time spent on a transport mode (transit time), in the absence of an economic theory which specifically addresses the issue of allocation of non-exclusive uses of time, we have made the assumption that non-exclusive waiting time can be incorporated into a de Serpa type framework and so treated in a similar manner as transit time. Therefore we have assumed that a valuation of a unit of waiting time can be derived from the estimation of a model of discrete choice between alternatives characterised by different monetary costs and different lengths of waiting list time. (It is worth noting that transit time is not necessarily

an exclusive use of time either; for example, individuals may read whilst travelling to work. Assuming they derive positive utility from reading, this will decrease the disutility of each unit of travel time).

2.3 Statistical requirements

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

Unfortunately, there is little observed (also referred to as revealed preference) data which can be used as a basis for the estimation of the value of waiting list time. Individuals cannot be observed making choices from which we can deduce their values of waiting time, because of the type of choices faced by consumers in the UK health care market. For illnesses for which waiting lists are used to allocate care, demanders either have to go on waiting lists or they may opt out of the NHS into the private sector. They cannot make trade-offs between

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

The alternative approach is to ask respondents to make choices between alternative courses of action within a hypothetical context and use the responses as measures of preference. In the current research, the alternatives put before the respondents would be designed to elicit measures of preference over time and money. From respondents' choices estimates of the value of waiting time could be derived. In seeking measures of preference in a hypothetical choice context, two types of method are commonly used. The first, labelled by Tversky et al. (1987) as 'matching', requires the

respondent to state the amount of an attribute (such as money) which will make him/her indifferent between the two alternatives he/she has been asked to choose between. The second method requires the respondent to rate or rank pre-specified alternatives. This is commonly referred to as 'Stated Preference' (hereafter referred to as SP). The analyst designs a set of hypothetical alternatives based on a limited set of attributes considered to be important and obtains from the respondent an indication of his/her relative preference for each of the alternatives. The simplest indicator of preference is the selection of one alternative from a two options (labelled 'choice' by Tversky et al. 1987). The exercise is then repeated a number of times, systematically altering the values of the attributes.

Stated Preference methodology has been widely used in the economic analysis of the value of transit time. The Journal of Transport Economics and Policy, volume 22, 1 (Jan 1988) carries extensive discussion on its use in this field . The methodology has been used in the health care field to determine the preference of demanders about the location and type of supplier of health care (Parker and Scrinivasan (1976); Wind and Spitz (1976)). The advantages of an experimental design are that the researcher can collect information which is closer to that required by the research than the information which can be derived from revealed preference data. In addition, the researcher may use the questionnaire design to

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

3. STATED PREFERENCE DESIGN

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

attributes for the alternatives, the numerical values for these attributes, the hypothetical context and the selection of respondents. These issues are interrelated; for example the choice of hypothetical context is in part determined by and determines the choice of attributes and the value of attributes.

3.1 Choice of attributes

The number of attributes which can be incorporated in each alternative is limited by the ability of respondents to distinguish between different alternatives. In addition, there is a trade-off between the number of attributes and the number of numerical values that each attribute can take. The number of pairs of alternatives (also referred to as replications) is given by

$$r = \prod_{k=1}^{K} \text{levels of attribute } k$$

To keep the number of replications to a minimum we restricted our focus to three attributes. As the aim of the research was to estimate the money value of a unit reduction in waiting list time, two of the attributes were obviously time and cost. These were specified in months and in pounds respectively. Additionally, since we wished to investigate whether the value of waiting time was systematically related to uncertainty over the length of

the wait, we included a third attribute, uncertainty of date of admission. This was specified as a dummy variable with value 1 if the date of admission was uncertain and value 0 otherwise.

3.2 Numerical values of attributes

Choice of the numerical values of the attributes was determined by a number of factors. First, as this study is, to our knowledge, the first to attempt to measure the value of waiting time for non-urgent medical treatment in the UK, we wished to allow for a wide range of values of time to be implicit in the choices respondents would make. Second, we wished to take advantage of the experimental situation and to design the alternatives given to respondents to limit the variance in the parameters of interest. Third, we felt it necessary to limit the number of choices each respondent would be faced with (each choice required the respondents to indicate preference for one of two alternatives). After considerable piloting the final set contained 14 pairwise choices. Fourth, we wished to be able to investigate non-linearities in the choice making process. Research using the stated preference approach in transport has indicated that utility differences might not be linear in attribute differences, but may also be a function of the levels of the attributes (Bates and Roberts 1983). This non-linearity has been termed a 'threshold' effect.

It was thought that threshold effects might arise in the context of a choice between waiting time and monetary cost because individuals might not feel able to trade off between time and cost at high level of cost. In other words, at high values of cost, choice would become lexicographic, alternatives being rated in terms of their money values rather than all their attributes. To permit investigation of lexicographic choice and other possible departures from the choice making process assumed in the random utility model underlying this research, two sets of replications were used. Two sets were used in the survey, but each respondent was allocated, at random, only one set. The two sets (referred to as the 'Pink' and 'White' sets respectively) are presented in Table 6.1. The ratio of waiting time to money cost in the pairs of alternatives (replications) in two sets is similar, but the levels of both time and cost attributes are higher in Pink Set. The cost and time values of replications 1-8 in this set are 50 percent higher than the cost and time values for the same replications in the White Set. This subset of replications was used to examine whether threshold effects are present. Replications 8-11 were identical in the two sets. Replications 12-14 had three functions; to make the average ratio of time to money similar in the two sets, to attempt to capture very high or very low values of time and to provide data for further tests of lexicographic choice.

Table 6.1

Values used in StatedPreference Replications

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

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

3.3 Hypothetical Context.

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

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

The choice of one of the two alternatives had to be made within the context of a need for non-urgent medical treatment. We had the option of either specifying a particular medical condition or describing the features of an unspecified condition. The second course was chosen. Use of a specific condition as the context has the advantage that the researcher can be sure that respondents are making the trade-offs in a known context only if he or she can be sure that all respondents have the same understanding of the context. If some

respondents have no experience of the named condition and/or some respondents have different experiences to others, the advantages of a specific named condition are lost. It was felt this might occur in this case, particularly as the type of conditions which could be named (i.e. for which waiting lists exist) can be fairly sex specific (e.g. hernias, varicose veins).

The hypothetical context was specified along the following lines. The respondent was asked to imagine that he/she had a medical condition which required an operation. Prior to this operation (implicitly the only treatment possible) the respondent would not be able to perform all his/her normal activities and would have to take a specified amount of time off work or from household duties. The condition would not deteriorate during a wait, but neither would it improve. Once the operation was performed, the respondent's health would return to normal. It was hoped that respondents would view this situation as associated with minimum anxiety over the possibility of deterioration of health status during the wait. As a check of understanding of the context, the respondents were asked whether they had made their choices with a specific condition in mind, and if the response was positive, to name the conditions. The scenario and the checks are presented on pp. 8-10 of the questionnaire in Appendix 4 .

3.4 Selection of respondents

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

choices could be meaningless, we excluded individuals under 25. Individuals over 70 were also excluded, as it was thought that this age group might include some individuals who found the task too difficult and so give unreliable responses.

4. MODEL SPECIFICATION

4.1 Segmentation

The basic model to be estimated is an extension of equation (13) incorporating the attribute uncertainty over date of admission. For any individual i, the deterministic component of random utility of option j is given by

$$V_{ij} = \alpha_j + \beta C_j + \psi T_j + \gamma W_j \qquad (14)$$

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

In moving from the individual specification of

equation (14) to an aggregate specification, it is reasonable to expect non-random variation in the parameters. For example, different individuals face different cost and time budget constraints and so are likely to have different coefficients β, ψ and γ. To allow for non-random variation in the model parameters it is necessary to segment the model on the basis of those characteristics of the individual believed to account for differences in the coefficients. The simplest form of segmentation is to estimate a given model separately for each group or segment in the sample. (In the limit, if respondents were given sufficient choices, one model could be estimated for each observation in the sample). However, this approach not only requires large sample sizes to obtain well defined coefficient estimates, but also introduces unnecessary distinctions between segments if some of the coefficients do not differ across segments. The alternative approach is to estimate a single model using all observations, but to reformulate the form of the model to permit different coefficients for different segments.

We can define a set of dummy variables such that,

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

These dummies are used to modify the explanatory variables to produce segment-specific variables and so segment-

specific coefficients. Reformulated, model (14) becomes

$$V_{ij} = \Sigma_{s=1}^{S} d_{is}[\alpha_{js} + \beta_s C_j + \psi_s T_j + \gamma W_j] \quad (15)$$

where S = total number of segments.

The variables and coefficients are interpreted as variables and coefficients for individuals in specific segments of the sample.

Using this framework, it is possible to test both whether the segmented model gives a better fit than an unsegmented (or less segmented model) and to test whether the coefficients on different segments are significantly different from each other. In principle, each variable in the SP design matrix could be segmented by one or more factors. For example, the time coefficient could be segmented by three factors, having K, L and M levels respectively. From this, as many as KxLxM segment specific coefficients could be identified. Estimation of such a large set of parameters is fairly onerous, and we adopted the simplifying assumption that there are no interaction effects between the different factors on which segmentation is based. In the terminology of general linear models we only consider additive effects (McCullagh and Nelder 1983). In the example given here, we would estimate only K+L+M segment specific coefficients.

4.2 Identification of segments

The decision to segment certain variables and the selection of the individual attributes by which segments are defined should be based on theoretical hypothesis about the nature of likely variation of the coefficients within the sample. In the current research, we have segmented the data to reflect the likely impact of budget constraints on the choices individuals can make. We have assumed that the marginal utility of income falls as income increases and therefore have segmented the cost coefficient by income. We have assumed that the time variables varied non-randomly with the opportunity cost of time spent on waiting lists, and so segmented the time variable on the basis of socio-economic activity and household responsibilities (defined as a single composite factor, rather than two separate factors). The time and cost variables were therefore each segmented by one factor (with K and M levels respectively).

The uncertainty variable was segmented on the basis of several additive factors, chosen to measure the disutility an individual might derive from uncertainty over the date of admission for hospital treatment. These factors include current and past health care utilization and health status, which allows us to investigate whether those in poorer health would get more disutility from uncertainty over the date of receipt of treatment. Health insurance cover was also included on the grounds that

those who currently buy health insurance are more likely to dislike the uncertainty imposed by waiting lists than those who do not have insurance.

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

Under these assumptions equation (14) was reformulated in the general form of equation (15) as follows. Dropping superscripts for the individual for convenience, the contribution of βC_j in (14) was replaced by

$$d_m \beta_m C_j$$

where m indexes an income group and M = 3 (i.e. three income groups were identified). The contribution of T_j

in equation (14) was replaced by

$$d_k \psi_k T_j$$

where k refers to socio-economic activity and household constraints on time. Initially, K was set equal to 6, the groups being the full-time employed, part-time employed with children, part-time employed without children, housewives with children, housewives without children and the retired.

The uncertainty variable was segmented by the variables discussed above, each factor defined as having two levels, but in order to maintain reasonable numbers of observations in each segment, the tests of segmentation on the uncertainty variable were carried out separately from tests of segmentations on the cost, time and intercept variables. Therefore segmentation on the uncertainty variable is excluded from the model formulation presented here. However, the model estimated, presented in equation (16) below, can easily be extended to allow for segment specific coefficients on the uncertainty variable.

Finally, the contribution of the constant term in equation (14) was replaced by

$$(d_m \alpha_m + d_p \alpha_p) + \alpha_j$$

where p indexes views about the role of the private sector, P = 3 and m indexes income as above. To avoid

linear dependencies, as the constant term (α_j) was not constrained to equal zero, only M-1 and P-1 dummies could be defined. The base categories were agreement with the statement that 'private medical practice should be allowed both inside and outside NHS facilities' and gross household income of over 350 pounds per week.

With these segmentations the deterministic component of the model is given by

$$V_{ij} = \alpha_j + \sum_{p=1}^{P-1} d_{ip}\alpha_p + \sum_{m=1}^{M-1} d_{im}\alpha_m + \sum_{m=1}^{M} d_{im}\beta_m C_j + \sum_{k=1}^{K} d_{ik}\psi_k T_j - \gamma W_j \quad (16)$$

where j indexes the option, and i the individual.

4.3 Specification of random error

The random utility function we seek to estimate is given by

$$U_{ijr} = V_{ijr} + e_{ijr} \quad (17)$$

where the subscript i references the individual, j the option and r the replication. For each replication and for each individual $V_{.j.}$ is specified as in equation (16). The error term in the SP case has a different interpretation from that of RP error term. In the standard RP interpretation of the discrete choice model,

the random element e_{ijr} is hypothesised to be due to 'unobservables' in the utility function which influence individual i's choice of alternative j in state r. In other words, a random element is associated with each alternative, each individual and each state. In SP the same individual is presented with a set of choices between alternatives; all that changes between replications is values of the attributes of the alternatives. Thus there seems no a priori reason for expecting the random element to vary across replications for one individual. In other words, the utility of alternative j in replication r for individual i can be specified as

$$U_{ijr} = V_{ijr} + e_{ij} \qquad (18)$$

In this case, we cannot treat the random element as being identically and independently distributed across all observations, an observation defined as a single replication for a single individual.

Bates (1988) has suggested that the SP response can be treated as having an implicit error term. In the current case, this error term arises because individuals can only indicate their preferences by selecting one alternative of a pair. Under binary choice, equation (18) can be respecified in terms of differences. The difference in utility between alternative j and j' is then

$$\Delta U_{ir} = \Delta V_{ir} + \Delta e_{i} \qquad (19)$$

where

$$\Delta U_{ir} = U_{ijr} - U_{ij'r}$$

$$\Delta V_{ir} = V_{ijr} - V_{ij'r}$$

$$\Delta e_i = e_{ij} - e_{ij'}$$

For each choice, say of alternative j in replication r, the researcher cannot know the exact difference between the utility of the two alternatives, ΔU_{ir}. Instead, he/she must make an approximation to the value of ΔU_{ir}, inferred from the (0,1) choice. Treating the responses as having an implicit error term n_{ir}, the estimation problem can be written

$$\hat{\Delta} U_{ir} = \Delta U_{ir} + n_{ir} \qquad (20)$$

and since from (19)

$$\Delta U_{ir} = \Delta V_{ir} + \Delta e_i$$

this means the observed response is specified as

$$\hat{\Delta} U_{ir} = \Delta V_{ir} + n_{ir} + \Delta e_i \qquad (21)$$

where n_{ir} is randomly distributed across replications and individuals and $(n_{ir}+e_i)$ is treated as a composite error term. The error term can then be specified as i.i.d. across observations.

5. MODEL ESTIMATION

5.1 Checks for Violations of Underlying Behavioural Model

The model assumed to underlie the choice between alternatives permits only random error. Error that is correlated with one or more of the attributes will result in inconsistent estimates of the value of waiting time. It is therefore important to attempt to identify individuals whose choice process might depart from that assumed by the random utility model, and to test for misspecification by estimating the model with and without this group. The questionnaire was designed to allow the researcher to make checks for different types of error. First, after completion of the Stated Preference exercise, respondents were asked two 'Transfer Price'(TP) (or 'matching') questions. These were questions Q19 and Q20 of the questionnaire. Both questions referred to the same scenario as the SP questions. In Q19 respondents were given a waiting time for treatment and asked to state the minimum sum of money they would be prepared to pay to avoid this wait. Q20 was the reverse of Q19; respondents were presented with a monetary sum and asked to state the minimum wait which they would be prepared to accept rather than pay[2]. Second, as noted above,the SP set was designed to allow the researcher to search for evidence of lexicographic choice.

From patterns in their responses to the SP and the TP question, certain respondents appeared to violate the behavioural assumptions of the choice model. The first group were respondents who gave the response 'couldn't pay' or 'wouldn't pay' to the TP questions. Of these, the former were perhaps indicating that they did not have the income to play the SP game; the latter that they would not play the game. Data collected as part of the survey indicated that the former group had significantly lower incomes than all other respondents in the sample, while the latter group were significantly more likely to agree with the statement that no private health care should permitted.

The second group were those respondents who appeared to be making lexicographic choices. Each set of SP trade-offs contained two pairs of replications in which the ratio of time to cost was identical in each pair of replications, but one replication in each pair had higher absolute levels of both attributes. Respondents who appeared to be making lexicographic choices in both of these pairs might not have been making trade-offs between time and money, but choosing on the basis of one attribute only (probably money). In addition, respondents who chose the pay alternative for the replication which had the highest ratio of time to cost, but chose the wait alternative for more than one other replication, and those respondents who chose the wait option for the replication with the lowest ratio of time to cost, but chose to pay in

more than one other replication, also might not have been trading between attributes.

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

5.2 Model Estimation

All models were initially estimated using only one of the two SP data sets (the White set). Several specifications of the segmentation variables were tested, and estimation was undertaken using nested data sets derived by omission of some of the pairs of replications. In addition, the models were estimated with and without those observations that appeared to be violating the behavioural model. Estimation of a preferred model using

the data from one set of SP questions and applying this model to the data from the other set is one test of model stability; comparison of the models estimated using a subset of the SP questions with those estimated using all SP questions is another. Model selection was made on the basis of formal and informal tests. These included score tests for normality (Bera, Jarque and Lee 1984), likelihood ratio tests of nested models and pairwise comparison of coefficients.

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

The preferred estimates are given Table 6.2 for

Table 6.2

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

(n = 341)

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

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

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

Table 6.3

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

(n = 344)

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

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

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

the White set and and Table 6.3 for the Pink set. These were derived omitting those observations which could have been violating the underlying behavioural model. Research in the transit literature has indicated that inclusion of respondents who appear to be violating the assumptions of the behavioural models may result in biased estimators and/or poorly defined coefficients (Fowkes and Wardman 1988). Our analysis indicated that inclusion of those respondents discussed in section 5.1 resulted in a better fitting model on some criteria, but a poorer fitting model on others. The results from estimation with all respondents are presented in Tables 6.4 and 6.5. The score tests for normality indicate slightly lower misspecification in the models of tables 6.4 and 6.5. However, the differences in the score test statistics are not large and although the coefficients on the time and cost variables are higher in Tables 6.2 and 6.3, the ratio of these coefficients, which gives the value of time, are very similar in the two sets of estimates. The main difference between the estimates derived with and without these observations is in the size of the constant term and in the variance covariance matrix of the parameter estimates. The constant terms and the standard errors of the estimates are smaller in the estimates of Tables 6.2 and 6.3 than in Tables 6.4 and 6.5. The differences in the constant terms indicate that the excluded group are more likely to choose the wait option, which was expected given that many of the excluded group only chose this

option. The stability of the value of time estimates between the two sets of estimates, together with the differences in the intercept terms, perhaps indicates that the source of misspecification reflected in the score tests for normality in Tables 6.2 and 6.3 may be the result of omission of variables which measure the propensity to choose the wait option. As our primary interest was in the time and cost coefficients, we thought it was not necessary to further model these differences in the intercept term.

As our preferred estimates, we selected those with the best fit in terms of the estimates of the value of time. This model was that with the smaller variance covariance matrix and was therefore the model estimated without the respondents discussed in section 5.1 above. The discussion below therefore applies to the estimates presented in Tables 6.2 and 6.3. However, it is worth stressing that in the main the estimates of Tables 6.4 and 6.5 are not dissimilar in magnitude, are of the same sign and are similar in precision.

5.3 Cost coefficients

The pattern of coefficients of the cost variable indicated that those with a higher income have a lower marginal valuation of cost. The segments were defined by gross household income of less than 150 pounds per week, between 150 and 349 pounds per week and 350 pounds and

Table 6.4

White Set: All Observations

(n = 491)

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

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

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

Table 6.5

Pink Set: All Observations

(n = 517)

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

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

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

over. Pairwise tests of coefficients for different segments indicated that differences between all three income groups were not statistically significant in all models, and the segmentation could be reduced to distinguish between respondents with household incomes of below and above 350 pounds per week[3]. Individual income was also used to define segments on this variable, but loglikelihood ratio tests indicated a better fit when household income was used .

5.4 Time coefficients

Initially, the time coefficient was segmented by a factor with 6 levels. In the estimation process, this was reduced to four, these being the full-time employed, the part-time employed, full-time housewives and the retired. Segmentation on the time variable generally seemed to reflect the extent of alternative uses of time spent on a waiting list whilst in a state of health below the normal level. The coefficient for the employed was higher than the coefficients for housewives. Healthy time may be more important to those who have to work in both household and market production. The presence of children in a household did not appear to affect the coefficient of the time variable. In the White set (Tables 6.2 and 6.4), the time coefficient for the part-time employed is smaller than, although not significantly different from, the time coefficient for the full time employed. In the Pink set

(Tables 6.3 and 6.5), the higher coefficient for the part-time employed is rather surprising. This result may stem from the presence in the part-time employed segment of a group of self-employed. In other analyses of the data (not shown here) the self-employed had a significantly higher time coefficient than the employed.

The high (relative) coefficient on time for the retired contrasts with studies of value of time savings in transport, in which the retired are found to have lower time variable coefficients (MVA et al. 1987). This may be the result of the different nature of the two goods. The disutility of extra time in a transport mode is low to the retired, who generally do not have fixed schedules or face many constraints on their daily allocation of time. However, when time is measured in units of months rather than minutes and waiting is associated with a lower health status, the retired may place a higher value on each month because their expected stock of months is smaller than that of younger individuals. The retired may therefore derive greater disutility from being on a waiting list than other individuals with the same income.

It is interesting to note that the students in the sample (who were excluded from the main analysis on the grounds of small numbers) had high values of time relative to housewives. Again, this result contrasts with findings in the economics of transport and again, the result may stem from the difference between transport and health care. Students have relatively few time constraints on

the uses of their time on a daily basis, but do have periods of the year in which time loss probably has a high disutility (such as the examination period). Hence, they may place a high value on short waiting times. In addition, because good health may be desired for the future as well as the present, students may consider the income constraint they face to be that of their families/parents, or related to their future expected income, rather than that defined by their current income.

The model was also specified with segmentation on the time variable by income (rather than socio-economic status). Whilst the results indicated that the coefficients for two of the three segments on the time variable were statistically different, the model fitted less well than that using segmentation on the basis of socio-economic status. To have segmented by both income and socio-economic status on time would have resulted in very small numbers in some of the segments (particularly the retired segments), so this possibility was not explored further.

5.5 Uncertainty coefficients

The coefficient on the uncertainty variable was insignificant in almost all specifications of the model. The uncertainty variable was segmented by various measures of health status (current health rating, worry about health, recent utilization of in- or out-patient hospital

services) and by health insurance cover (whether or not the respondent had cover) to identify those groups which might derive different amounts of disutility from uncertainty. None of the estimated segment-specific coefficients were significantly different from zero. This may reflect the relative unimportance of uncertainty of admission date in a situation in which individuals are faced with choices which involve large sums of cost or long waits. In other words, whether or not the actual admission date is known or only known to within a two month range is irrelevant. The choice is dominated by the values of the time and cost variables. However, this result may also be due to the particular specification of the uncertainty variable in the SP design.

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

date of admission was the mean of the distribution given in the SP replications would be correct. However, if the distribution of assumptions about the length of wait under uncertainty were not random, then the specification used in model estimation would be incorrect. Pilot work showed that respondents appeared to be able to distinguish between a known and an unknown admission date and that respondents did make different assumptions about the length of wait within a given range. More thought that they were more likely to be admitted later (i.e. towards the end of the range) rather than sooner. But there appeared to be no clear patterns of association in the pilot studies between socio-economic variables, health status or health utilization and the perceived length of wait implied by the uncertainty variable, so this finding could not be incorporated into the analysis.

5.6 The alternative specific constant

There are significant differences in the propensity to choose to pay rather than wait between respondents. The dummy variables on the intercept term for political attitudes indicates that those who agreed with the statement that no private care should be permitted were significantly less likely to pay than those who agreed with the statement that private care should only be allowed outside the NHS. The latter group were in turn significantly less likely to pay for care than those who

felt that the private sector should be allowed to operate both inside and outside the NHS (the omitted dummy). The signs of the dummy variables for income indicate that the lowest income group were significantly less likely to chose the pay alternative than the middle income group, who were in turn less likely to choose this alternative than the highest income group (the omitted dummy). Correlation between insurance cover, income and attitudes to private medicine resulted in high covariance between the estimates of the coefficients for the alternative specific dummies when the model was specified with all three sets of segmentation, so segmentation by the insurance status of the respondent was dropped. Other analyses indicated respondent self-rating as not being in poor health appears to be associated with a greater propensity to choose the pay alternative and it is likely other socio-economic variables will also be associated with the propensity to choose this alternative. However, it was not thought that the variables would account for non-random variation in the coefficients of cost, time or uncertainty, so these issues were not explored further.

5.7 Estimates of the Value of Time

The estimates of the values of the utility of a unit reduction in waiting list time derived by the models of Tables 6.2 to 6.5 are presented in Table 6.6. This table indicates that the value of time is significantly

Table 6.6

Estimated Value of Waiting List Time (£/month)

Segment	All individuals		Excluding non-respondents to TP Questions	
	White set	Pink set	White set	Pink set
Weekly household income below £350				
Full time employed	41.3	34.63	41.90	36.51
	(2.78)	(2.95)	(2.75	(2.69)
Part-time employed	30.9	45.6	35.70	43.07
	(3.44)	(3.89)	(3.45)	(3.56)
Housewife	21.4	33.7	20.40	32.93
	(3.49)	(3.53)	(3.97)	(3.22)
Retired	29.49	39.8	43.43	43.32
	*	*	(3.97)	(4.28)
Weekly household income above £350				
Full time employed	47.8	40.7	49.43	44.73
	(4.82)	(4.69)	(4.81)	(4.64)
Part-time employed	35.8	53.6	42.11	52.75
	(4.81)	(6.27)	(5.09)	(5.92)
Housewife	24.8	39.7	24.06	40.33
	(4.47)	(5.26)	(4.41)	(5.02)
Retired	34.2	46.8	49.90	53.01
	*	*	(5.04)	(6.67)
Average across all segments	36.02	37.7	37.69	38.17
	(2.79)	(2.97)	(2.70)	(2.68)

Standard errors in parentheses (* indicates s.e. could not be calculated from first order approximation given below)

Note

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

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

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

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

different from zero for all segments. The value of time of the lower income groups in both sets is below that of the higher income groups and the value of time of housewives below that of the retired and the employed. The standard errors of the estimates indicate that the estimates from the Pink set do not differ significantly from the estimates from the White set of replications. The standard errors indicate that the value of time for the full time employed, the part-time employed and the retired do not differ significantly from each other in either set. However, it was felt that the stability of the direction of the estimates was some indication of a pattern across segments and the large standard error for the higher income, retired group was in part a consequence of the small numbers in this segment. Accordingly, the segmentation between the employed, the retired and housewives was retained although it appears that the employed could be treated as one, rather than two, groups.

Collapsing all segments, we obtain a single value of waiting time from each set of replications (presented at bottom of Table 6.6). The estimates for each set differ significantly from zero, but do not differ significantly between the two sets. The average cost per month for the four groups considered here ranges between 32.39 and 42.99 pounds in the White set (95 percent confidence interval around the mean). Comparison of the estimates of the model using all observations with those derived from estimation excluding those respondents who

may have been violating the behavioural assumptions of the random utility model, indicates that the estimates from the smaller sample are slightly, but not significantly, higher. As many of the excluded group selected the wait option in all replications, this result is as expected.

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

5.8 Comparison with Previous Estimates

Cullis and Jones (1986) assumed that there are 38.64 million weeks of waiting on non-urgent list in the NHS per annum. Using the Lindsay and Feigenbaum

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

6. CONCLUSIONS

The coefficients of the estimated models are generally well defined and of a priori expected sign. The estimates of the value of waiting time are consistent across the two different sets of SP replications. They are similar to those derived from a series of SP questionnaires carried out as part of the pilot phase of the project using different sets of replications with different ranges of time to cost ratios and different methods of administration[4]. The results seem to indicate that some individuals do make trade-offs between time and cost and that these trade-offs could be used to give some indication of the value of time saved if certain types of waiting list were reduced. Unfortunately, we are not able to check the validity of our results by comparison with the findings of research other than the Cullis and Jones result. Few other researchers have attempted to measure the costs of waiting lists or to estimate the value of time spent waiting for medical care. None, to our knowledge, have used a Stated Preference Approach. As noted above, our estimates are considerably lower than those given by Cullis and Jones but, as mentioned, there are grounds for believing the latter to be rather high.

The research has raised many issues, some of which still remain unresolved. We consider briefly two of these. The first concerns the design of SP questionnaires to estimate the value of non-traded goods in the NHS, the

second the applicability of such valuations to decisions about resource allocation. The first is important for future applications of the SP methodology in estimation of values of time, the second central to the use of such values.

While around 70 percent of the respondents in the sample appeared to complete the SP task in a manner consistent with the assumption that individuals would trade off time against cost, a significant minority of the sample might not have been making these trade-offs. While this has not resulted in substantially different estimates of the value of time, inclusion of this group increases the standard error of the estimates. The size of this group is important for future use of this methodology in the field of health care. For the purposes of questionnaire design, two distinct groups can be identified in this minority. The first group are those who may not have the income to be able to play the game as it was designed. We were well aware of this problem during the design stages of the research. However, the design was restricted by the need to place the choices within a framework which was close to that which respondents either have experienced or could see as possible. The nature of the health care system in the UK means that waiting lists have a duration of weeks or months rather than days, and that the costs of care outside the NHS is in terms of hundreds rather than tens or units of pounds. Specification of the alternatives as characterised by

short waits and low cost, while overcoming the problem of those respondents who 'could not' pay, would set the SP choices within a framework which is a long way from current practice. This would only increase any problems of reliability and validity of responses. The pilot stages seemed to indicate that respondents felt that situations in which waits were short and costs low were less realistic than those characterised by longer waits and higher costs. The payment of money to avoid only the queue appeared comprehensible to most respondents in the pilot phase. (As patients can choose to see consultants privately and then be referred back into the NHS, this form of payment is perhaps not that far from current practice).

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

questionnaire for each group. As an example, in the SP work in transport, business travellers have been given SP replications with higher ratios of cost to time than leisure travellers (MVA et al (1987)).

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

The second issue we wish to consider briefly is the applicability of values derived from the current type of research to the evaluation of projects within the NHS. All the empirical results derived from the current research relate to behavioural costs. They are values which, given certain assumptions about the nature of preferences, best account for the reported behavioural intentions of the respondents. A behavioural value of time represents the money that an individual would be prepared to pay to save a unit of time for him/herself. As such, like values from revealed preference demand studies,

the value is based upon ability to pay. The values are therefore derived within the particular normative framework of individual consumer sovereignty and private calculus. Other discussions of the costs of NHS waiting lists to demanders are also set within this framework and it is therefore useful for this research to have used the same framework. Our estimates can also be compared with the values of other types of time estimated by researchers using the same methodology and normative framework in different fields.

In contrast, an 'evaluation' value of time represents the amount of money a public agency would be prepared to pay to save a unit of time for an individual. The behavioural and evaluation values will differ whenever the welfare function used by the public agency differs from the sum of individual utility functions. Generally, the Social Welfare Function takes into account elements in the valuation which are not considered by the individual. Such elements include misperception of costs and benefits by the individual, factors which will lead to a divergence between private and social cost and differences between individual and social rates of time preference. The divergence between behavioural and evaluation values will depend on the number and extent of these elements and upon the notions of equity and distribution embodied in the SWF. We do not intend by our research to defend the consumer sovereignty approach on the grounds of equity. Rather, the private welfare calculus is often used as a

starting point for valuation in cost-benefit analyses of public sector projects, so the behavioural valuation of waiting list time derived here could be used as one starting point for the estimation of the evaluation value of waiting list time.

NOTES

1. All fieldwork was undertaken by a professional social survey organization, Social and Community Planning and Research (SCPR). Details of the survey are given in Appendix 4.

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

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

4. The SP set in the pilot questionnaires had a smaller range of implied value of time. In some of the pilot questionnaires time was specified in weeks rather than months. All were self rather than interviewer administered. They were completed by two groups of employees in the York region and by various types of conference delegates and holiday visitors at York University in late 1985.

CONCLUSIONS

The research in this thesis has examined three aspects of consumer behaviour in the mixed private-public UK health care market. The starting point for each analysis has been either an analytical or an econometric model of behaviour. To test these models we have employed computer simulation, estimation using revealed preference data from both secondary sources and surveys conducted specifically for the research and estimation using data collected by means of quasi-experimental SP techniques. In this conclusion we review the principle results of each part of the research. For each part, we examine of a number of issues which have been raised in this work but are as yet unresolved. We also outline a research project which has begun to examine some of these issues, using the research reported here as the starting point.

This thesis began with an examination of the demand for private health insurance in the UK. An analytical model of demand which explicitly takes into account the limited nature of both the private health care sector and the contracts offered in the private health insurance market was developed. A computer simulation of this model confirmed and extended the analytical predictions: econometric estimation using the GHS as the data base indicated the importance of income and

employment status in determining purchase. The estimation results also suggest that it is appropriate to view the decision making unit as the family rather than the individual.

The econometric analysis indicated that there may be other factors which are associated with the purchase of private health insurance which the research has not been able to take into account. In addition, the research has led us to question the appropriateness of an analytical model which posits that consumers perceive the decision to purchase health insurance as a one period decision and reassess their decisions in the light of marginal changes in their circumstances. Estimation of such a model has indicated that variables measuring current period income, employment, family composition, health status and recent utilisation of the health services account for only part of the variance in the decision to purchase health insurance. In part, the relatively poor fit of the econometric model may be due to the limited nature of the data, a problem hardly unique to the current study. However, it may also be the case that a model which assumes consumers take a one period view of health insurance which covers (some) medical care costs for only one period is an incorrect representation of behaviour. There would seem to be a case for developing a model of the demand for health insurance which incorporates rather stronger bounds on rationality than the one period expected utility model proposed in Chapter 2. The expected

utility framework was used, not because it is the only description of behaviour under uncertainty, but because it was felt that other alternatives to expected utility are currently too embryonic to be applied to an analysis of health insurance purchase. However, the current research results suggests that it would be useful to explore a model which gives greater weight to the effect of past decisions and incorporates the notion of restricted choice sets. As discussed in Chapter 4, there is currently no data with which to explore these issues. However, on the basis of the research reported here, we have initiated a project to explore these issues. We have carried out a small national survey to investigate the reasons for both purchase and non-purchase of health insurance. Using a mixture of precoded and open-ended questions, the survey focused upon the role of past decisions, life cycle events, such as marriage and retirement, the monetary costs of purchase, attitudes to risk and political attitudes to private sector health care.

The survey netted approximately 1300 individuals. Preliminary analysis of the data suggests that individuals do not appear to reconsider their health insurance purchase decision annually. Rather, the decision to consider insurance purchase appears to be associated with changes in financial circumstances and with life cycle events, such as retirement. The data also seem to support the captivity hypothesis discussed in Chapter 4. For some individuals, private health insurance does not

ever appear to have been part of their choice set, because of their income, or their health status (either good or poor) or their political attitudes towards private health care. For other, health insurance is a good to be considered seriously only in the future, when health or financial circumstances change. Future research will use this data to explore the issue of captivity, using it to estimate the parameters of a model which explicitly takes into account the effect of restricted choice sets.

A demand for health insurance in the UK context implies a demand for private health care. As a complement to the analysis of the demand for health insurance, we analysed the determinants of the expenditure on private health care (or equivalently, the insurance claims) of a sample of the insured. The investigation began with a discussion of the nature of the claims process in the UK. From this we developed a model of claims as the outcome of three distinct decisions, each determined by a separate, though possibly overlapping, set of factors. The likelihood function for this process was specified under different assumptions about the extent of statistical dependence between the three decisions. The econometric results indicated that the decision to seek medical care is statistically independent of the other two decisions and that the level of claims is weakly dependent on the probability of making a claim. The parameter estimates indicated that the three stages are associated with different factors. The decision to seek care appears to

be, as would be expected, a function of health status. The referral decision appears to be a function of the nature of the insurance contract and also of income, which is interesting given the high level of cover provided by the health insurance contracts. The level of claims is primarily associated with health status, as measured by the utilisation of health care facilities, but also appears to be associated with the corporate or non-corporate nature of the insurance cover.

The estimation results suggest that there are differences in the claims patterns of different subscriber types. The significant difference in the probability of making a claim between those with the older Unit and Standard cover is easily explained in terms of the lower cover offered by the older policies. The significant difference in both the probability of making a claim and the level of claims between those subscribers with corporate cover and those with non-corporate cover is less easily accounted for, but suggests either that the two groups differ in terms of risk (of having medical care conditions which can be treated in the private sector) or differ in their propensity to make a claim. It would be interesting to explore such issues further. However, such an exploration would require more detailed information on respondents' knowledge of their health insurance cover and of their health status than was available for the current research. It is unlikely that such data can be collected regularly from subscriber files or even by postal

questionnaire, the two sources used in the research reported here. Similarly, rather more detailed data than could be collected in the current research would seem to be required to investigate the extent and nature of co-temporaneous use by the insured of private and public facilities. Better understanding of these issues is important for analysis of the impact of increased private sector provision of health care in the UK. For example, it is required to analyse the effectiveness of measures to restrict the level of claims or of policy changes which allow individuals to 'opt out' of NHS tax contributions and entitlement to NHS provided care.

We stated in the Introduction to the thesis that, ideally, the demand for private health care and the demand for health insurance should be modelled and estimated simultaneously. Our results suggest that this approach, whilst theoretically elegant, would be unlikely to lead to well defined parameter estimates unless a larger and more detailed data set were to be made available.

The third topic examined in this work was the cost, to the consumer, of the allocation of certain types of care by waiting list. Specifically, we sought an estimate of the monetary value of the disutility of a month of time spent on a list waiting for treatment for a medical condition with a low decay rate. As in the rest of the research discussed here, our starting point was an analytical model and a specific econometric specification of this model. However, there were no data sets in the

public domain which could be used to estimate this model. Thus we sought to collect data for our specific purpose. We adopted the Stated Preference methodology to elicit preferences for time over money and used these to estimate the disutility of a unit of time spent waiting. . The overall response rate to the questionnaire was high. A high proportion of the respondents appeared to complete the Stated Preference task in a manner not inconsistent with the assumptions of the theoretical model we sought to estimate. The estimates of the value of time derived from the data were fairly stable and indicated systematic differences in the value of time for different socio-economic groups in the sample.

The nature of the health care system in the UK means that it is not always possible to provide answers to important policy questions using data on observed actions. For example, in a health care market in which almost all primary care and most secondary care is provided free at the point on demand, there exists little revealed preference data with which to estimate, say, the monetary price elasticity of demand. Using revealed preference data, the response of demand to price can only be assessed for services for which price is positive. Hence, perhaps, the interest in the demand for prescriptions and for dental care (e.g. Lavers (1983); Ryan and Birch (1988)). However, the data in such cases often has serious shortcomings (Lavers (1983)) and it seems almost inevitable that there will be some questions which cannot

be answered using revealed preference data. In such cases, the researcher is forced to examine other means of collecting data. Revealed preference data from laboratory type experiments may be one avenue: however, the work presented here seems to indicate that data derived from responses to choices made within a hypothetical context may also be an avenue worth exploring.

First, the SP technique has been extensively tested in transport economics. This provides the researcher with knowledge of the strengths and weaknesses of the methodology at the design, rather than the end, stage of the research. Second, the present research has explored some of the issues that may be particular to SP work in the UK health care field. For example, we have tested whether individuals will make trade-offs at high values of time and money. We have explored the possibility of lexicographic choice. We have identified groups who appear not to be able to make trade-offs and have drawn attention to the association between willingness to choose to pay for medical care and political attitudes. Third, the SP approach has the advantage that the researcher can simultaneously collect data and test the the assumptions underlying the model he or she is trying to estimate. As decision making in the health care field is characterised by uncertainty, and our understanding of the process of decision making under uncertainty currently extremely limited, such tests would seem both appropriate and useful. In conclusion, the

research reported here suggests that it would be worth exploring the Stated Preference methodology in more depth. Given the lack of revealed preference data, our work suggests data derived using this methodology could be a useful input for the analysis of policy issues in the UK health care market.

REFERENCES

Acton, J.P. (1976) "The Demand for Medical Care Amongst the Urban Poor" in R.N. Rosett (ed) The Role of Health Insurance in the Health Care Market, New York: NBER and Neale and Watson.

Aitchison, J. and Brown, J.A.C. (1957) The Lognormal Distribution, Cambridge: CUP.

Amemiya, T. (1973) "Regression Analysis When the Variance of the Dependent Variable is Proportional to the Square of its Expectation" Journal of the American Statistical Association 68,344,928-934.

Amemiya, T. (1984) "Tobit Analysis: A Survey" Journal of Econometrics 24, 3-61.

Amemiya, T. (1985) Advanced Econometrics, Oxford: Basil Blackwell.

Arrow, K. (1963) "Uncertainty and the Welfare Economics of Medical Care" American Economic Review 53, 941-973

Association of Independent Hospitals (1985) Year Book 1985

Barr, N. (1987) The Economics of the Welfare State, London: Weidenfeld and Nicolson

Barzel, Y. (1974) "A Theory of Rationing by Waiting" Journal of Law and Economics 53, 73-95

Barzel, Y. (1981) "Competitive Typing Arrangements: The Case of Medical Insurance" Economic Inquiry 19, 4, 598-612.

Bates, J.J. (1987) "Measuring Travel Time Values with a Discrete Choice Model: A Note" Economic Journal 97, 493-498.

Bates, J. J. (1988) "Econometric Issues in SP Analysis" Journal of Transport Economics and Policy 22, 1, 59-70.

Bates, J.J. and Roberts, M (1983) "Recent Experience with Models fitted to Stated Preference Data" PTRC Summer Annual Meeting, Brighton, Paper N8.

Becker, G. (1965) "A Theory of the Allocation of Time" Economic Journal 75, 493-517

Bera, A.K., Jarque, C.M. and Lee, L.F. (1984) "Testing the Normality Assumptions in Limited Dependent Variable Models" International Economic Review 25 3, 563-578.

Blundell, R.W., Ham, J. and Meghir, C. (1986) "Unemployment and Female Labour Supply" UCL Discussion Paper 86-06.

Bosanquet, N. (1987) "Private Health Insurance in Britain and the National Health Service " Geneva Papers in Risk and Insurance 12, 45, 350-357..

BUPA (1988) "Your Guide to Private Medicine and what BUPA means to You and Your Family" (Advertising Brochure).

Cairns J. and Snell M. (1978) "Prices and the Demand for Health Care" in A. J. Culyer and K. Wright (eds) Economic Aspects of the Health Service, London: Martin Robertson and Co.

Coffey, R. (1983) "The Effect of Time Price on the Demand for Medical Care" The Journal of Human Resources 18 3, 406-424.

Cosslett, S. (1981) "Efficient Estimation of Discrete Choice Models" in C. Manski and D. McFadden (eds) Structural Analysis of Discrete Data with Econometric Applications, Cambridge: M.I.T. Press.

Cragg, J.G. (1971) "Some Statistical Models for Limited Dependent Variables with Applications to the Demand for Durable Goods" Econometrica 39, 829-844.

Cullis, J.C. and Jones, P.R. (1985) "National Health Service Waiting Lists: A Discussion of Competing Explanations and a Policy Proposal"Journal of Health Economics 4, 119-135.

Cullis, J.C. and Jones, P.R. (1986) "Rationing by Waiting Lists: An Implication" American Economic Review 76 1, 250-256.

Culyer A.J., Donaldson, C. and Gerard, K. (1988) "Financial Aspects of Health Services: Drawing on Experience" Institute of Health Services Management, London, Working Paper No. 3.

Davidson, T., and MacKinnon, J.G. (1984) "Convenient Specification Tests for Logit and Probit Models" Journal of Econometrics 25, 241-262.

Deaton, A. and Irish, M. (1984) "Statistical Models for Zero Expenditure in Household Budgets" Journal of Public Economics 23, 59-80.

Devlin, B. and Lunn, J. N. (1986) "Confidential Inquiry into Perioperative Deaths" British Medical Journal 292, 1622-3.

Domencich, G. and McFadden, D. (1975) Urban Travel Demand, Amsterdam: North Holland.

Dowie, R (1983) General Practitioners and Consultants: A Study of Outpatient Referrals, London: King Edwards Hospital Fund.

Duan, N., Manning, W.G., Morris, C. and Newhouse, J.P. (1982) "A Comparison of Alternative Models for the Demand for Medical Care" Paper R-2754- HHS Rand Corporation, Santa Monica C.A. 00406 USA.

Duan, N., Manning, W.G., Morris, C. and Newhouse, J.P. (1984) "Choosing between the Sample Selection Model and the Multi-Part Model" Journal of Business and Economic Statistics 2, 3, 283-289.

Ehrlich, I. and Becker G.S. (1972) "Market Insurance, Self Insurance and Self-Protection" Journal of Political Economy 80 (Jul-August), 623-648.

Feldstein, M (1973) "The Welfare Loss of Excess Health Insurance" Journal of Political Economy 81, 2,251-280

Feldstein, M. and Friedman, B. (1977) "Tax Subsidies, the Rational Demand for Insurance and the Health Care Crisis" Journal of Public Economics 7, 2, 155-178.

Fowkes, T. and Wardman, M. (1988) "The Design of Stated Preference Travel Choice Experiments with Particular Regard to Inter-Personal Travel Variation" Journal of Transport Economics and Policy 22, 1, 27-44

Gaudry, M. and Dagenais, M. (1979) "The Dogit Model" Transportation Research B, 13B, 105-111.

Gillam, D. (1985) "Referrals to Consultants - the NHS versus private practice" Journal of the Royal College of General Practitioners 35, 15-18

Grant, C. (1985) "Private Health Care in the U.K.: A Review" Economist Intelligence Unit, Special Report No. 207.

Greene, W. H. (1985) Limdep Users Manual.

Hay, J. W. and Olsen, R. J. (1984) "Let Them Eat Cake: A Note on Comparing Alternative Models of the Demand for Medical Care" Journal of Business and Economic Statistics 2, 3, 279-282.

Heckman, J. J. (1976) "The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models" Annals of Economic and Social Measurement 5, 4, 475-492.

Hey, J. D. (1981) Economics in Disequilibrium, Oxford: Martin Robertson.

Holmer, M. (1984) "Tax Policy and the Demand for Health Insurance" Journal of Health Economics 3, 203-221.

Iversen, T. (1986) "An Interaction Model of Public and Private Health Services: Surgical Waiting Lists" in A.J. Culyer and B. Jonsson (eds) Public and Private Health Services, Oxford: Basil Blackwell

Iversen, T. (1987) "Some Aspects of Queues and Waiting Lists Problems in the Health Services" Paper presented at the 8th Nordic Health Economists Study Group, Turku, August 24-25

Jones, A. (1987) "A Double Hurdle Model of Cigarette Consumption" IRISS Discussion Paper 128, University of York.

Judge, G., Hill, R.C., Griffiths, W., Lutkepohl, H. and Lee, T-C. (1981) Introduction to the Theory and Practice of Econometrics, New York: Wiley.

Keeler, E.B. Newhouse, J.P. and Phelps, C.E. (1977) "Deductibles and the Demand for Medical Services: The Theory of a Consumer Facing a Variable Price Schedule under Uncertainty" Econometrica 45, 641-655.

Kind, P., Rosser, R. and Williams, A. (1982) "Valuations of Quality of Life: some Psychometric Evidence" in M. W. Jones-Lee (ed) The Value of Life and Safety, 159-170.

Laing, W. (1985) Private Health Care 1985, Office of Health Economics.

Laings Review of Private Health Care 1987, London: Laing and Buisson Publications Ltd.

Lavers, B. (1983) "The Effect of Price Changes on the Demand for and Cost of Pharmaceutical Prescriptions 1970-1981" Paper presented to the International Conference on Health Economics, Lille, France, Sept. 14-16.

Lindsay, C. (1980) National Health Issues: The British Experience, London: Hoffman LaRoche.

Lindsay, C. and Feigenbaum, B. (1984) "Rationing by Waiting Lists" American Economic Review 74 3, 404-417, June 1984.

McCullagh, P. and Nelder, J.A. (1983) Generalised Linear Models, London: Chapman and Hall.

McFadden, D. (1974) "The Measurement of Urban Travel Demand", Journal of Public Economics 3, 303-328.

McFadden, D. (1981); "Econometric Models of Probabilistic Choice" in C. Manski and D. McFadden (eds) Structural Analysis of Discrete Data with Econometric Applications Cambridge: MIT Press.

Machina, M. (1983) "The Economic Theory of Individual Behaviour towards Risk: Theory, Evidence and New Directions" Centre for Research on Organizational Efficiency Technical Report 433, Standford University.

Maddala, G.S. (1983) Limited Dependent and Qualitative Variables in Econometrics, Cambridge : CUP.

Manski, C. and Lerman S (1977) "Estimation of Choice Probabilities from Choice Based Samples" Econometrica 45, 1977-88.

Manski, C. and McFadden, D. (1981a) "Alternative Estimators and Sample Design for Discrete Choice Analysis" in C. Manski and D. McFadden (eds), Structural Analysis of Discrete Data with Econometric Applications, Cambridge: MIT Press.

Manski, C. and McFadden, D. (1981b) Structural Analysis of Discrete Data with Econometric Applications, Cambridge: MIT Press.

Marquis, S. (1983) "Consumers' Knowledge About their Health Insurance Coverage" Health Care Financing Review 5, 65-80 (Fall 1983).

Maynard, A. (1982) "The Private Health Care Sector In Britain" in G. McLachlan and A. Maynard (eds) The Public/Private Mix for Health, Nuffield Provincial Hospitals Trust.

Maynard, A. (1988) "Alternative Patterns of Funding Health Care: The Search for the Holy Grail" mimeo, Centre for Health Economics, University of York.

de Meza, D. (1983) "Health Insurance and the Demand for Medical Care" Journal of Health Economics 2, 47-54.

M.V.A. Consultancy, Institute for Transport Studies, University of Leeds and Transport Studies Unit, Oxford (1987) The Value of Time Savings, Newbury, Berks: Policy Journals

Newhouse, J. P. (1981) "The Demand for Medical Care Services: a Retrospective and a Prospective" in J. van der Gaag and M. Perlman (eds) Health, Economics and Health Economics, Amsterdam: North-Holland.

Nordquist, G. and Wu, S. (1976) "The Joint Demand for Health Insurance and Preventative Medicine" in R. N. Rosett (ed) The Role of Health Insurance in the Health Services Sector, New York: Universities - National Bureau of Economic Research Joint Conference No. 27, Neale Watson.

Office of Population Census and Surveys General Household Survey 1982, London: HMSO.

Orme, C. (1987) "Specification Tests for Binary Data Models" Mimeo, Department of Economics, University of Nottingham.

Parker, B. and Scrinivasan, V. (1976) "A Consumer Preference Approach to the Planning of Rural Primary Health-Care Facilities" Operations Research 24, 5, 991-1025.

Parkin, D.W. and Yule, B. (1984) "Economic Interpretation of Supplier Induced Demand" HERU Discussion Paper 03/84, University of Aberdeen.

Pauly, M. (1974) "Overinsurance and Public Provision of Insurance: The Roles of Moral Hazard and Adverse Selection" Quarterly Journal of Economics 88, 44-62.

Phelps, C.E. (1976) "The Demand for Reimbursement Insurance" in R. Rosett (ed) The Role of Health Insurance in the Health Services Sector, New York: Universities - National Bureau of Research Joint Conference 27, Neale Watson.

Phelps, C. (1978) "Illness Prevention and Medical Insurance" Journal of Human Resources 13 (Supplement) 103-207.

Phelps, C.E. and Newhouse, J.P. (1974) "Coinsurance, the Price of Time and the Demand for Medical Services" Review of Economics and Statistics 56, 334-342.

Poullier, J. (1986) "Levels and Trends in the Public-Private Mix of the Industrialized Countries' Health Systems" in A. J. Culyer and B. Jonsson (eds) Public and Private Health Services, Oxford: Basil Blackwell.

Puffer, F. (1987) "The Effect of Regional and Class Differences in the U.K. on Access to Health Care". Paper presented at Health Economics Study Group Meeting, Warwick University, January 1987.

Ryan, M. and Birch, S. (1988) "Estimating the effects of Health Service charges: Evidence on the utilization of prescriptions" CHE, University of York Discussion Paper 37

Schulenberg, J. M. Graf v.d. (1986) "Optimal Insurance Purchasing in the Presence of Compulsory Insurance and Uninsurable Risks" Geneva Papers on Risk and Insurance 11,38,5-16.

de Serpa, A.C. (1971) "A Theory of the Economics of Time" Economic Journal 81, 828-846.

Swait, J.D. and Ben-Akiva, K. (1985) "Analysis of the Effects of Captivity on Travel Time and Cost Elasticities", Proceedings of the International Conference on Travel Behaviour, Nordwijk, Netherlands 1985, 113-128.

Truong, T. and Hensher, D. (1985) "Measurement of Travel Time Values and Opportunity Cost from a Discrete-Choice Model" Economic Journal 95, 438-451.

Truong, T. and Hensher, D. (1987) "Measuring Travel Time Values with a Discrete Choice Model: A Reply" Economic Journal 97, 499-501.

Tversky, A., Sattah, S. and Slovik, P. (1987) "Contingent Weighting in Judgement and Choice" Mimeo, Department of Psychology, Stanford University.

Varian, H.R. (1978) Micro Economic Analysis, New York: W.W. Norton and Co.

van de Ven, W.P.M.M. and van Praag, B. (1981a) "The Demand for Deductibles in Health Insurance" Journal of Econometrics 17, 229-252.

van de Ven, W.P.M.M. and Van Praag, B. (1981b) "Risk Aversion and Deductibles in Private Health Insurance: Application of an Adjusted Tobit Model to Family Health Care Expenditures" in J. van der Gaag and M. Perlman (eds) Health, Economics and Health Economics, Amsterdam: North Holland.

Williams, B.T. Nicholl, J.P, Thomas, K.J., Knowelden, J. (1985a) "Differences in Length of Stay for Surgery in the NHS and Private Sector in England and Wales" British Medical Journal, March 30, 978-981.

Williams, B.T., Nicholl, J.P., Thomas, K.J., Knowelden, J. (1985b) "Contribution of the Private Sector to Elective Surgery in England and Wales" The Lancet July 14, 89-92.

Wind, Y. and Spitz, L. (1976) "Analytical Approaches to Marketing Decisions in Health Care Organizations" Operations Research 24, 5, 973-990.

Winter, D. (1987) "The Demand for Health Care Revisited". Paper presented at Health Economics Study Group Meeting, Warwick University, January 1987.

Zweifel, P. (1982) "Demand for Supplementary Health Insurance in Switzerland: A Theoretical and Empirical Investigation" Geneva Papers on Risk and Insurance 7, 24, 207-236.

APPENDIX 1

Simulation Programme for Chapter 3

As outlined in the chapter, several variants of the basic model were used in the simulation exercise. The functions which differed between programmes were the utility function, the nature of the distribution of sickness, f(s) and the specification of the premium. The appended programme listing is therefore representative of the various simulations, but not the only version of the programme. In the appended listing, utility is specified as an exponential function, f(s) is truncated lognormal and the premium is actuarially fair.

```
      PROGRAM SIMLOG
c     prog simlog is same as sim except distribution of
c     sickness is truncated lognormal with params mu and variance sig2
c
      include 'sim_def.for'
      real para(21)
      equivalence (para(1),alph),(para(2),bet), (para(3),gam),
     1 (para(4),a), (para(5),mean), (para(6), max), (para(7), w),
     2 (para(8),t), (para(9), e), (para(10),r), (para(11),p),
     3 (para(12),ma), (para(13),mb), (para(14),mc), (para(15),la1),
     4 (para(16),lb1), (para(17), lb2), (para(18),lc2), (para(19),ui),
     5 (para(20),mu), (para(21),sig2)
      open (unit=10, file='siml.dat',status='old',err=998)
      open (unit=20, file='sim.res',status='new',err=999)
      read (10,100) alph,bet, gam
      read (10,100) a, mean,max
      read (10,100) w,t,e,r,p
      read (10,100) ma, mb, mc, la1, lb1, lb2, lc2, ui, mu, sig2
      read (10,200) symb, start, end, rinc
      write (20,800) 'SIMLOG1: lognormal f(s), exp U, fair prem'
      write (20,400) symb(1:4) ,start,end,rinc
      ifail = 1
      write (* ,300) alph, bet, gam, a, mean, max, w, t, e, r, p, ma, mb,
     1 mc, la1, lb1, lb2, lc2, ui,mu,sig2
      write (20,300) alph, bet, gam, a, mean, max, w, t, e, r, p, ma, mb,
     1 mc, la1, lb1, lb2, lc2, ui, mu,sig2
      j = 0
      call symbol(j,symb)
      do 2 z = 0,10
      dummy=start+(end-start)*z/rinc
      para(j) = dummy
      call star(sstar)
      call hat(shat)
      call prem(shat)
      call compare(sstar,shat,eno,eins, diff)
      write (*,600) dummy, sstar, shat, sub,eno, eins, diff
2     write (20, 600) dummy, sstar, shat, sub, eno, eins, diff
      stop
998   write (20,700) 'data'
999   write (20, 700) 'output'
      stop
100   format (5x,f7.2)
200   format (a4,1x, 3f6.0)
300   format (//, ' Initial Parameter Values',/,
     1 ' alph=', f10.5,/, ' bet =', f10.5 ,/, ' gam = ', f10.5 ,/,
     2 ' a   =', f10.5,/,
     3 ' mean=', f10.5,/, ' max =', f10.5, /, ' w   =', f10.5,/,
     4 ' t   =', f10.5,/, ' e   =', f10.5, /, ' r   =', f10.5,/,
     5 ' p   =', f10.5,/, ' ma  =', f10.5, /, ' mb  =', f10.5,/,
     6 ' mc  =', f10.5,/, ' la1 =', f10.5, /, ' lb1 =', f10.5,/,
     7 ' lb2 =', f10.5,/, ' lc2 =', f10.5, /, ' ui  =', f10.5,/,
     8 ' mu  =', f10.5,/, ' sig2=', f10.5,/)
400   format(/,1x,  'parameter',4x, 'minValue', 5x, 'maxValue',5x,
     1 'Step',/, 1x, a4, 13x,3(f10.4,7x))
600   format (1x, ' param', 5x, ' sstar',6x, 'shat',7x, 'sub',
     1 8x, 'eno', 8x,'eins', 7x, 'diff in EU',/, 1x, f8.4, 6f11.4,/)
700   format (/, ' error opening', a8)
800   format (/, ' program type', a50 )
      end
c*************************************************************************
```

```
c       Select param to be changed
        subroutine symbol(j,symb)
        include 'sim_def.for'
        if (symb(1:4) .eq. 'alph') then
                j = 1
        else if (symb(1:4) .eq. 'bet ') then
                j = 2
        else if (symb(1:3) .eq. 'gam') then
                j = 3
        else if (symb(1:1) .eq. 'a') then
                j = 4
        else if (symb(1:4) .eq. 'mean') then
                j = 5
        else if (symb(1:3) .eq. 'max') then
                j = 6
        else if (symb(1:1) .eq. 'w') then
                j = 7
        else if (symb(1:1) .eq. 't') then
                j = 8
        else if (symb(1:1) .eq. 'e') then
                j = 9
        else if (symb(1:1) .eq. 'r') then
                j = 10
        else if (symb(1:1) .eq. 'p') then
                j =11
        else if (symb(1:2) .eq. 'ma') then
                j=12
        else if (symb(1:2) .eq. 'mb') then
                j = 13
        else if (symb(1:2) .eq. 'mc') then
                j = 14
        else if (symb(1:3) .eq. 'la1') then
                j = 15
        else if (symb(1:3) .eq. 'lb1') then
                j = 16
        else if (symb(1:3) .eq. 'lb2') then
                j = 17
        else if (symb(1:3) .eq. 'lc2') then
                j = 18
        else if (symb(1:2) .eq. 'ui' ) then
                j = 19
        else if (symb(1:2) .eq. 'mu' ) then
                j = 20
        else if (symb(1:4) .eq. 'sig2')then
                j = 21
        end if
        return
        end
c*******************************************************************************
c       money costs of treatment
        function m(s)
        include 'sim_def.for'
        m = ma + mb*s + mc*s**2
        return
        end
c*******************************************************************************
c       time loss due to illness, NHS treatment
        function  tl1(s)
        include 'sim_def.for'
        tl1 = la1+lb1*s
```

```
      return
      end
c*************************************************************************
c     time loss due to illness, private treatment
      function tl2(s)
      include 'sim_def.for'
      tl2 = lb2*s+lc2*s**(3/2)
      return
      end
c*************************************************************************
c     lognormal distribution of sickness
      function f(s)
      include 'sim_def.for'
      ifail = 0
      pi = 3.14159
      if (s .le. 0.0) goto 100
      d1 = 1.00/(s*sqrt(sig2)*sqrt(2.0*pi))
      d2 = (alog(s) - mu)/(sqrt(sig2))
      d2 = d2*d2*(0.5)
      d2 = exp(-d2)
      d3 = d2*d1
      x  = (alog(max) - mu)/sqrt(sig2)
      g  = 1.00 - s15ace(x,ifail)
      f = d3/g
      return
100   f = 0.0
      return
      end
c*************************************************************************
c     Utility of NHS
      function u1(s)
      include 'sim_def.for'
      y = ui+(w*e) - (e*a*tl1(s))
      h = t - w - (1.0 - a)*tl1(s)
      if (h .le. 0.0) goto 200
      u = alph*(1.0 - exp(-bet*y*h))
      u1 = u
      return
200   h = 1.1
      u = alph*(1.0 - exp(-bet*y*h))
      u1 = u
      return
      end
c*************************************************************************
c     Utility of private pay as you go
      function u2(s)
      include 'sim_def.for'
      y = ui+(w*e) - (e*a*tl2(s))- m(s)
      h = t - w - (1.0 - a)*tl2(s)
      if (h .le. 0.0) goto 200
      u = alph*(1.0 - exp(-bet*y*h))
      u2 = u
      return
200   h = 1.0
      u = alph*(1.0 - exp(-bet*y*h))
      u2 = u
      return
      end
c*************************************************************************
c     Utility of insurance in private sector without sub
```

```
      function u3(s)
      include 'sim_def.for'
      y = ui+(w*e) - (e*a*tl2(s))
      h = t - w - (1.0 - a)*tl2(s)
      if (h .le. 0.0) goto 200
      u = alph*(1.0 - exp(-bet*y*h))
      u3 = u
      return
200   h = 1.0
      u = alph*(1.0 - exp(-bet*y*h))
      u3 = u
      return
      end
c*************************************************************************
c     Utility of insurance in  public sector without sub
      function u4(s)
      include 'sim_def.for'
      y = ui+(w*e) - (e*a*tl1(s))
      h = t - w - (1.0 - a)*tl1(s)
      if (h .le. 0.0) goto 200
      u = alph*(1.0 - exp(-bet*y*h))
      u4 = u
      return
200   h = 1.1
      u = alph*(1.0 - exp(-bet*y*h))
      u4 = u
      return
      end
c*************************************************************************
c     Utility of insurance in private sector
      subroutine ru3(s,u3r)
      include 'sim_def.for'
      y = ui+(w*e) - (e*a*tl2(s))-sub
      h = T - W - (1.0 - a)*tl2(s)
      if (h .le. 0.0) goto 200
      u = alph*(1.0 - exp(-bet*y*h))
      u3r = u
      return
200   h = 1.0
      u = alph*(1.0 - exp(-bet*y*h))
      u3r = u
      return
      end
c*************************************************************************
c     Utility of insurance in  public sector
      subroutine ru4(s,u4r)
      include 'sim_def.for'
      y = ui+(w*e) - (e*a*tl1(s))-sub
      h = t - w - (1.0 - a)*tl1(s)
      if (h .le. 0.0) goto 200
      u = alph*(1.0 - exp(-bet*y*h))
      u4r = u
      return
200   h = 1.1
      u = alph*(1.0 - exp(-bet*y*h))
      u4r = u
      return
      end
c*************************************************************************
c     Difference between private and nhs utility
```

```
      subroutine dnoins(s,d1)
      include 'sim_def.for'
      d1 = u2(s) - u1(s)
      return
      end
c*************************************************************************
c     Difference between insured and NHS (for those with ins)
      subroutine dins(s,d2)
      include 'sim_def.for'
      d2 = u3(s) - u4(s)
      return
      end
c*************************************************************************
c     Find s* at which indifferent between public and private
      subroutine star(sstar)
      include 'sim_def.for'
      rinc = 100.0
      s    = 0.0
100   call dnoins(s,d1)
      if (d1 .eq. 0.0) goto 300
      if (d1 .lt. 0.0) goto 200
      if (s  .gt. max) goto 400
      s = s+rinc
      goto 100
200   if (rinc .lt. 0.0001) goto 300
      if (s .lt. 0.0)       goto 500
      s = s-rinc
      rinc = rinc*0.1
      goto 100
300   sstar = s
      return
400   sstar = max
      return
500   sstar = 0.0
      return
      end
c*************************************************************************
c     Find shat at which indifferent btween pub and pr insured
      subroutine hat(shat)
      include 'sim_def.for'
      rinc = 100.0
      s    = 0.0
100   call dins(s,d2)
      if (d2 .eq. 0.0) goto 300
      if (d2 .lt. 0.0) goto 200
      if (s  .gt. max) goto 400
      s = s+rinc
      goto 100
200   if (rinc .lt. 0.0001) goto 300
      if (s .lt. 0.0)       goto 500
      s = s-rinc
      rinc = rinc*0.1
      goto 100
300   shat = s
      return
400   shat = max
      return
500   shat = 0.0
      return
      end
```

```
c*************************************************************************
c       Evaluate insurance premium
        subroutine prem(shat)
        include 'sim_def.for'
        external fn5
        rint = 0.0
        epsr = 0.001
        nlimit = 10000
        ifail = 0.0
        rint = d01ahe(0.0,shat,epsr,npts,relerr,fn5,nlimit,ifail)
        sub = (1.00+r)*p*rint
        return
        end
c*************************************************************************
c       Expected utility of NHS
        function fn1(s)
        include 'sim_def.for'
        f1 = u1(s)*f(s)
        fn1 = f1
        return
        end
c*************************************************************************
c       Expected utility of private pay as you go
        function fn2(s)
        include 'sim_def.for'
        f2 = u2(s)*f(s)
        fn2 = f2
        return
        end
c*************************************************************************
c       Expected utility of insured in pr sector
        function fn3(s)
        include 'sim_def.for'
        call ru3(s,u3r)
        fn3 = u3r*f(s)
        return
        end
c*************************************************************************
c       Expected utility of ins in public sector
        function fn4(s)
        include 'sim_def.for'
        call ru4(s,u4r)
        fn4 = u4r*f(s)
        return
        end
c*************************************************************************
c       Ins payout in each state
        function fn5(s)
        include 'sim_def.for'
        fn5 = m(s)*f(s)
        return
        end
c*************************************************************************
c       Difference between Expected utility of no insurance and insurance
        subroutine compare(sstar, shat, eno,eins, diff)
        external fn1, fn2, fn3, fn4
        include 'sim_def.for'
        rint1=0.0
        rint2=0.0
        rint3 = 0.0
```

```
      rint4 = 0.0
      u3 = 0.0
      u1 =0.0
      eno = 0.0
      eins = 0.0
      epsr = 0.001
      nlimit = 10000
      ifail =0
      rint1 = d01ahe(0.0, sstar,epsr, npts, relerr, fn2, nlimit, ifail)
      rint2 = d01ahe(sstar, max, epsr, npts, relerr, fn1, nlimit, ifail)
      y = ui +(w*e)
      h = t - w
      u1 = alph*(1.0 -exp(-bet*y*h))
      eno = (rint1 + rint2)* p + (1.0 - p)*u1
      rint3 = d01ahe(0.0, shat,epsr, npts, relerr, fn3, nlimit, ifail)
      rint4 = d01ahe(shat, max, epsr, npts, relerr, fn4, nlimit, ifail)
      y = ui+ (w*e) - sub
      h = t - w
      u3 = alph*(1.00-exp(-bet*y*h))
      eins = (rint3 + rint4)* p + (1.0 - p)*u3
      diff = eins - eno
      write (*, 100) rint1, rint2,rint3,rint4,u1,u3
      write (20,100) rint1, rint2,rint3,rint4,u1,u3
      return
100   format (13x, 'rint1',6x, 'rint2', 6x, 'rint3',6x, 'rint4', 6x,
     1  'u1', 8x, ' u3',/, 8x, 6f11.4)
      end
c*******************************************************************************
```

SIM_DEF.FOR

```
      character *4 symb
      common alph, bet, gam,a, mean, max, w,t,e,r,p, ma,mb,mc, .
     1  la1, lb1, lb2, lc2, ui, mu, sig2, sub
      real  mean, max, ma, mb, mc, mu, la1, lb1, lb2, lc2
```

SIML.DAT

```
alph= 300.0
bet = 0.0001
gam = 0.0
a   = 0.5
mean= 0.1
max = 100.0
w   = 8.0
t   = 24.0
e   = 15.0
r   = 0.12
p   = 0.5
ma  = 50.0
mb  = 5.0
mc  = 3.0
la1 = 5.0
lb1 = 1.0
lb2 = 1.0
lc2 = 0.5
ui  = 2000.0
mu  = 1.6
sig2= 0.1
bet =0000.10.0005    10
```

APPENDIX 2

An extensive analysis of choice between two certain alternatives, McFadden (1974, 1981) has shown that the econometric estimation of discrete choice between certain alternatives has a foundation in utility maximisation if utility is specified as a random function which is additively separable in a deterministic and a random component. Further, under certain specifications of the form and distribution of the error component this model of utility maximisation can be estimated by either probit or logit statistical models.

Although it has been shown that decisions makers make errors in assessment of choice under uncertainty, the appropriate way the model this randomness is as yet unresolved (Machina, 1983). One possible approach is to try to apply the idea of random utility as defined by McFadden to choice under uncertainty between two or more discrete alternatives. However, the extensions of random utility to choice under uncertainty is less than straightforward. In this brief note, we outline McFadden's argument and then attempt to extend the specification of randomness to choice under uncertainty. We basically attempt to introduce some notion of randomness into an expected utility framework. We show that if the error process is assumed to have a particularly simple, and perhaps not very plausible form,

the coefficients from the statistical model be interpreted as in the McFadden model ie. as the parameters of the deterministic component of utility.

A.2.1. Random Utility Model

McFadden assumed utility is a random function of the form

$$U(x^j,s) = V(x^j,s)+e(x^j,s) \qquad (A1)$$

where $U^j(.)$ is the random utility derived from the jth choice, $V^j(.)$ is the deterministic component and reflects the 'representative' tastes of the population and $e^j(.)$ is stochastic and reflects the effect of individual idiosyncrasies in taste, errors in judgement and/or errors of measurement by the analyst. The arguments of the utility function $V^j(.)$ are the attributes of the choice, x^j and the socio-economic characteristics of the choice maker, s (fixed across options for each choice maker).

The individual will choose the option which maximises random utility; since utility is stochastic, the even that an individual will choose option i is stochastic and will occur with some probability p^i, written as

$$p^i = Pr[U(x^i,s)>U(x^j,s) \text{ for } j \neq i,\ j = 1,\ldots,\ J] \qquad (A2)$$

For simplicity of exposition let $U(x^j,s)=U^j$, $V(x^j,s)=V^j$ and $e(x^j,s)=e^j$.

Substituting (A1) into (A2) and rearranging

$$p^i = Pr[e^j-e^i)<(V^i-V^j) \text{ for } j \neq i,\ j = 1, \ldots, J] \quad (A3)$$

The choice of estimator depends on the specification of the probability distribution of U^j and so (e^j-e^i). It is assumed that e^j are i.i.d. and independent of any of the factors which determine V^j.

Two probability distributions for (e^j-e^i) are commonly assumed. These are the logistic and the normal, which result in the estimation of the logit and probit models respectively. The two models are virtually indistinguishable except at arguments yielding probabilities close to zero or one, where the probit model approaches the extreme values more rapidly.

If the deterministic component $V(x^j,s)$ can be specified in the general linear form,

$$V(x^j,s) = Z(x^j,s)'\beta \quad (A4)$$

where the $Z(x^j,s)$ are known functions of the attributes of the choices and socio-economic characteristics of the choosers and β is a vector of unknown parameters, the β s

have the simple interpretation of the weights attached to the Z(.) functions in the calculation of utility. These weights are implicitly the same in all states of the world. In an estimation of a logit model where the dependent variable is L if the individual is observed to choose option i, 0 otherwise, β^k is the estimate of the effects of a unit of change in Z^k on the log of the odds ratio $p^i/(1-p^i)$.

A.1.2. Choice under uncertainty

The widely used expected utility theory of choice under uncertainty argues that expected utility of option i, EU^i is given as

$$EU^i = \Sigma_t \; p_t \; U_t^i \qquad \text{(A5)}$$

where i indexes the choice, t the state and

U_t^i = utility of i in state t

p_t = (subjective) probability of state t occurring

and $\Sigma_t p_t = 1$

Expected utility theory does not permit error on the part of the decision maker. To estimate a statistical model of choice between prospect i and prospect j when

expected utility is defined as in equation (A5) requires an assumption of errors in measurement by the observer. The problem of this approach for discrete choice is that errors in measurement must account for movement between non-choice and choice of option i, rather than intramarginal changes in the amount of a good consumed. In addition, there is a growing body of literature (for a review see Machina, 1983) which indicates individuals do make errors of judgement in situations of choice between uncertain prospects. However, although there is evidence of behaviour which violates expected utility maximisation, there is no general consensus as to the nature of the error process.

If error can be modelled as entering only the calculation of the utility of a choice i in state t and not into the assessment of the probability state t occurs, then the expected utility framework can perhaps be extended to incorporate random utility as modelled by McFadden. An extension that is perhaps most in keeping with McFadden is to respecify the utility of choice i in state t as stochastic, of the form

$$U_t^i = V_t^i + e_t^i \qquad \text{(A6)}$$

where V_t^i is a deterministic component and e_t^i a random component, assumed independent of V_t^i.

Substituting equation (A6) into (A5) the 'random' expected utility of choice i is

$$EU^i = \Sigma_t p_t \ (V_t^i + e_t^i) \tag{A7}$$

and substituting this definition of expected utility into (A2) and rearranging the probability an individual will choose i rather than j is

$$p^i = Pr[\Sigma p_t (e_t^j - e_t^i) < \Sigma p_t (V_t^i - V_t^j) \quad \text{for } j \neq i,\ j = 1, \ldots, J] \tag{A8}$$

The differences between the errors and the differences between the deterministic components are now state weighted differences. If the deterministic component of utility of choice i in state t is specified as in equation (A4), i.e.as a linear component of known attributes to vary across states, the deterministic component of utility for choice i in state t is given as

$$V_t^i = Z(x_t^i, s)'\beta_t \tag{A9}$$

Substituting (A9) into (A8) and rearranging the probability of choice of prospect i becomes

$$p^i = Pr[\Sigma p_t (e_t^j - e_t^i) < \Sigma p_t \beta_t (Z_t^i - Z_t^j) \quad \text{for } j \neq i,\ j = 1, \ldots, J] \tag{A10}$$

From equation (A10) it is clear that the parameters of either a logit or probit model can be related to the weights attached to each of the attributes of the choice if the weights are state independent ie. $\beta_t^k = \beta^k$, k=1, ..., J. This, in turn, implies state independent utility functions.

APPENDIX 3

BUPA

CONFIDENTIAL

HEALTH AND EMPLOYMENT IN 1984

This questionnaire asks you to provide a few details about yourself and your family's health and employment in 1984. It can be filled in by yourself or, if more convenient, by your husband or wife. It should take no more than 15-20 minutes to complete.

You need only provide details for members of your immediate family (yourself, your husband or wife and your children) who were living in your household in 1984. Questions should be completed for all such immediate family members whether or not they were covered by your BUPA policy.

Section 4 is only applicable for those with child dependants in 1984. If not applicable for you, go straight to section 5 after completing sections 1, 2, & 3.

The questions should be answered by circling the number corresponding to the appropriate answer or by writing the answer in the space provided.

FOR OFFICE USE ONLY

SECTION 1

HOUSEHOLD COMPOSITION IN 1984

This section to be completed for all members of the BUPA member's family living in the same household in 1984.

1. Please could you supply the following details for yourself and other members of your immediate family.

	Age (State in years)	Sex (Enter M if male; F if female)
BUPA member.....	.....	.....
Husband/ wife of BUPA member.....	.....	.....
Eldest child....	.....	.....
Second child....	.....	.....
Third child.....	.....	.....
Fourth child....	.....	.....
Subsequent children.....	.....	.....

2. Has the composition of your household changed since the end of 1984?

Yes..... 1

No..... 2

If yes, please specify how .....

.....

FOR OFFICE USE ONLY

3. Have you moved to another town or city since the end of 1984?

Yes..... 1 ☐

No..... 2

If yes, please specify the town/city and county in which you lived in 1984.

Town/City (or nearest town/city) ☐☐☐☐

.....

County..... ☐☐

4. Please indicate with a tick which members of your household were covered by your BUPA subscription in 1984. (Leave blank if not covered).

BUPA member	.....	☐
Husband/wife	.....	☐
Eldest child	.....	☐
Second child	.....	☐
Third child	.....	☐
Fourth child	.....	☐
Subsequent children	.....	☐

5. For how many years prior to 1984 had you had private health insurance? Please include policies other than BUPA. (If 1984 was the first year you had health insurance please record as 0)

Number of years ..... ☐☐

Go to Section 2

FOR OFFICE USE ONLY

SECTION 2

EMPLOYMENT IN 1984

This section should be completed for the BUPA member and for the husband or wife of the BUPA member only if he/she was part of the household in 1984.

6. Please indicate which of the following categories best describe your employment status in 1984. Circle all that apply.

	BUPA Member	Husband/Wife
Full time (over 30 hrs per week) self employed	01	01
Part time self employed	02	02
Full time (over 30 hours per week) employee	03	03
Part time employee	04	04
In full time education	05	05
Retired	06	06
Permanently unable to work because of illness	07	07
Unemployed	08	08
Keeping House	09	09

Other (please specify) .....

If not working full or part time in 1984, go to Section 3

7. Which of the following categories best describes your main job. Circle only one.

	BUPA Member	Husband/Wife
Clerical	1	1
Manual	2	2
Managerial/Professional	3	3

FOR OFFICE USE ONLY

8. For your main job in 1984, after what length of time would your earnings/income have been affected if you were unable to work because of illness? Please circle as appropriate.

	BUPA Member	Husband/Wife
Less than 1 week	1	1
1 - 2 weeks	2	2
3 - 4 weeks	3	3
1 - 3 months	4	4
4 - 6 months	5	5
More than 6 months	6	6

Go to Section 3

FOR OFFICE USE ONLY

SECTION 3

HEALTH OF BUPA MEMBER AND HUSBAND/WIFE

Answers to the questions in this section should be provided for the BUPA member and the husband or wife.

9. Thinking about your health in the last three years, how would you rate it for someone of your age? Please circle as appropriate.

	BUPA Member	Husband/Wife	
Very Good	1	1	☐
Fairly Good	2	2	☐
Not Good	3	3	

10. Do you currently have any long standing illness, disability or disease (by long standing, we mean something that has troubled you over a period of two years of more)? Please circle as appropriate.

	BUPA Member	Husband/Wife	
Yes	1	1	☐
No	2	2	☐

11. How often do you worry about your health? Please circle as appropriate.

	BUPA Member	Husband/Wife	
Not at all	1	1	
Not very much	2	2	☐
Fairly often	3	3	☐
A great deal	4	4	

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Now, please could you think about your health in 1984

12. In 1984, which of the following forms of health care did you make use of? Please circle all that apply.

	BUPA Member	Husband/Wife
Visit to GP	1	1
Dental care	2	2
Visit to hospital casualty department	3	3
A specialist consultation	4	4
Other visit to hospital out-patients	5	5
Hospital in-patient stay	6	6

Other consultation/
treatment (please specify).....

.....

If you have circled either 4 and/or 6, go to Question 13.
Otherwise, go to to Question 19.

13. In 1984 how many visits did you make on your own behalf to a specialist for consultation? Please state.

	BUPA Member	Husband/Wife
Number of visits	.....	.....

If none, go to question 16

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14. How many of these visits were as an NHS patient?
Please state number of visits.

	BUPA Member	Husband/Wife
Number of visits as an NHS patient	.....	.....

15. How many of these visits were as a private patient?
Please state number of visits.

	BUPA Member	Husband/Wife
Number of visits as a private patient	.....	.....

16. How many hospital inpatient stays did you have in 1984?
Please state number of in-patient stays

	BUPA Member	Husband/Wife
Number of in-patient stays	.....	.....

If none, go to Question 19

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17. For each of your first 3 hospital in-patient stays in 1984, please specify briefly what treatment you received and the name and town of the hospital in which you were treated and whether you received treatment as a private or NHS patient.

		BUPA Member	Husband/Wife
First In-patient Stay	Treatment	.....	.....
	Hospital	.....	.....
	Town	.....	.....
	Private or NHS Patient	.....	.....
Second In-patient Stay	Treatment	.....	.....
	Hospital	.....	.....
	Town	.....	.....
	Private or NHS Patient	.....	.....
Third In-patient Stay	Treatment	.....	.....
	Hospital	.....	.....
	Town	.....	.....
	Private or NHS Patient	.....	.....

If you were an NHS patient for all in-patient stays, go to Question 19. Otherwise, go to Question 18.

18. For each in-patient stay, please can you indicate whether or not you used your BUPA health insurance to meet the costs of any part of your treatment. Please circle as appropriate.

		BUPA Member	Husband/Wife
First Stay	Used BUPA insurance	1	1
	Did not use BUPA insurance	2	2
Second Stay	Used BUPA insurance	1	1
	Did not use BUPA insurance	2	2
Third Stay	Used BUPA insurance	1	1
	Did not use BUPA insurance	2	2

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19. Prior to 1984, how many times had you stayed in hospital overnight or longer? Please exclude hospital stays that resulted from childbirth.

	BUPA Member	Husband/Wife
Number of in-patient stays	.....	.....

If you had no children in your household during 1984, plese go to section 5 - otherwise please go to Section 4

FOR OFFICE USE ONLY

SECTION 4

HEALTH OF CHILDREN

Please complete only for children who were living in your household in 1984.

20. How would you rate the general health of each child in your household? Please circle as appropriate.

	Very Good	Fairly Good	Not Good	
Eldest Child	1	2	3	☐
Second Child	1	2	3	☐
Third Child	1	2	3	☐
Fourth Child	1	2	3	☐
Subsequent Children	1	2	3	☐

21. Earlier in the questionnaire you stated how much you worry about your own health. Would you now please indicate how much you worry about the health of your children? Please circle as appropriate.

Not at all	1	
Not very much	2	
Fairly often	3	☐
A great deal	4	

Now please could you think about your children's health in 1984.

22. In 1984, how many times did your children have to visit a specialist? Please exclude visits to Accident and Emergency Departments. Please state the total number of specialists visits by all children.

Total number of visits ..... ☐☐

If none, go to Question 25

FOR OFFICE USE ONLY

23. How many of these visits were as an NHS patient? Please state the number of specialist visits as NHS patients by all children.

Total number of visits ..... ☐☐

24. How many of these visits were as a private patient? Please state the number of specialist visits as private patients by all children.

Total number of visits ..... ☐☐

25. In 1984, how many times did any of your children have to stay in hospital overnight or longer? Please exclude stays in hospital in relation to childbirth. Please state the total number of in-patient stays by all children.

Total number of in-patient stays ..... ☐☐

If none, go to Question 28

26. How many of these in-patient stays were as an NHS patient?

Total number of stays by all children ..... ☐☐

27. How many of these were as a private patient?

Total number of stays by all children ..... ☐☐

28. Prior to 1984, how many times did any of your children have to stay in hospital overnight or longer? Please exclude stays in hospital in relation to childbirth. Please state the total number of in-patient stays by all children.

Total number of stays by all children ..... ☐☐

Go to Section 5

FOR OFFICE USE ONLY

SECTION 5

HOUSEHOLD INCOME IN 1984

29. Could you please indicate into which band your gross household income fell in 1984.

Under	£ 5,000.....	1
£5,000 -	£ 9,999	2
£10,000 -	£14,999	3
£15,000 -	£19,999	4
£20,000 -	£24,999	5
£25,000 -	£29,999	6
£30,000 -	£34,999	7
Over	£35,000	8

Please put the questionnaire into enclosed envelope and return to BUPA

THANK YOU VERY MUCH FOR YOUR PARTICIPATION

APPENDIX 4

SOCIAL AND COMMUNITY PLANNING RESEARCH

Head Office
35 Northampton Square,
London, EC1V 0AX.
Telephone: 01-250 1866

P.932 March - April 1987

CHOICES IN HEALTH CARE

SCPR is carrying out a survey about choices in health care. We are interested in your experiences of the health services and in views about waiting for hospital treatment. We want to talk to people who have had to wait and to those who have not had that experience.

The survey is bieng carried out for the Centre for Health Economics at the University of York. The Centre does research on all aspects of health policy and health services. This piece of research is being funded by the Health Promotion Research Trust.

Your address was selected at random from the electoral register. Your participation is, of course, entirely voluntary, but we hope you will spare a little time to talk to our interviewer. Any information you give will be treated as strictly confidential and will only be seen by people directly involved in the research at SCPR and York University. The results of the survey will be summarised in such a way that no one person's views or household details can be identified.

Thank you for your help. If there is anything more you would like to know, please contact me at the above address.

Catrin Morrissey

Catrin Morrissey
Project Researcher

SCPR
SOCIAL AND COMMUNITY PLANNING RESEARCH
Head Office. 35 Northampton Square London EC1V 0AX. Tel: 01-250 1866
Northern Field Office: Charazel House Gainford Darlington Co. Durham DL2 3EG. Tel: 0325 730 888

P.932

NHS WAITING LISTS
RESPONDENT SELECTION SHEET

March 1987

CONSTITUENCY [ ][ ] ADDRESS SERIAL NO. [ ][ ][ ][ ] ← SELECTION DIGIT

COMPLETE AND RETURN RESPONDENT SELECTION SHEET (RSS) FOR EACH ADDRESS CONTACTED (CODE BB ON P.2 OF A.R.F.)

INTRODUCTION

I work for SCPR, an independent research institute. We are conducting a study for the University of York about health and choices in health care. This address has been selected at random from the electoral register. Can you help me check which person I should interview at this address ... READ OUT FULL ADDRESS FROM ARF. (This will only take a minute or two).

1.a) Can I check first, is there one household at this address, or more than one? By household, I mean people who use the same living room or share at least one meal a day.

CARD 1 CONT'D (122)

One	1	Q.2
More than one	A	b)

IF 'MORE THAN ONE' - CODE 2 AT a)

b) Select from • WHOLE ADDRESS OR • DWELLING UNIT } CODE WHICH

Whole address	2	Q.2
Dwelling unit	3	c)

IF 'DWELLING UNIT' - CODE 4 AT b)

(123-124)

c) RECORD TOTAL NUMBER OF DWELLING UNITS AT ADDRESS — NUMBER [ ][ ] d)

d) LIST EACH BELOW IN LOCATION ORDER. USE GRID OVERLEAF TO MAKE SELECTION (SELECTION DIGIT AND NUMBER OF DWELLING UNITS)

LOCATION OF DWELLING UNIT	'DU' CODE
	1
	2
	3
	4
	5
	6
	7
	8
	9

RING 'DU' CODE TO INDICATE SELECTED UNIT GO TO e) BELOW

VISIT SELECTED UNIT AND ASK:

(125-26)

e) Including yourself, how many people aged 18 to 69 live in this part of this address?

CODE OR ENTER

1 person only	01 →	INTERVIEW THAT PERSON
Number of persons aged 25-69	[ ][ ]	Q.3
None aged 25-69	00 →	END

		Col./ Code	Skip to
2.	IF 'ONE HOUSEHOLD' (Q.1a CODE 1) OR 'WHOLE ADDRESS SELECTION (Q.1b CODE 3)		
	Including yourself, how many people aged 25 to 69 live at this address? — 1 person only	(127-28) 01 →	INTERVIEW THAT PERSON
	CODE OR ENTER — Number of persons aged 25-69	[ ][ ]	Q.3
	None aged 25-69	00 →	END

3. IF TWO OR MORE PERSONS AGED 25-69 (SEE Q.1e AND Q.2)

a) LIST BELOW ALL PERSONS AGED 25 TO 69 IN ALPHABETICAL ORDER OF THEIR FIRST NAMES

FIRST NAMES	PERSON CODE
	1
	2
	3
	4
	5
	6
	7
	8
	9

REMEMBER TO RING PERSON CODE OF SELECTED PERSON

b) USE GRID TO SELECT. GO DOWN COLUMN REPRESENTING TOTAL PERSONS AGED 25-69 UNTIL YOU COME TO THE ROW FOR THE SELECTION DIGIT. THE NUMBER GIVEN WHERE COLUMN AND ROW MEET IS THE PERSON CODE OF PERSON TO INTERVIEW. RING PERSON CODE ABOVE TO INDICATE SELECTED PERSON.

c) ENTER FULL NAME OF SELECTED PERSON ON ARF SLIP. INTERVIEW THAT PERSON ONLY

SELECTION GRID

SELECTION DIGIT (LAST DIGIT OF SERIAL NUMBER	TOTAL PERSONS 25-69 IN HOUSEHOLD (ADDRESS) *(total number of Dwelling Units)*							
	2	3	4	5	6	7	8	9
0	1	3	3	2	1	5	4	7
1	2	1	1	4	3	6	5	9
2	1	2	2	5	4	3	1	4
3	2	1	4	3	5	7	6	8
4	1	3	2	1	6	2	1	6
5	2	1	3	5	1	7	4	2
6	1	2	4	3	2	5	3	1
7	2	1	3	2	4	1	7	5
8	1	3	2	1	3	4	2	6
9	2	2	1	4	5	6	8	3

IF 10 OR MORE SEE PROJECT INSTRUCTIONS

SCPR
SOCIAL AND COMMUNITY PLANNING RESEARCH
Head Office: 35 Northampton Square London EC1V 0AX. Tel: 01-250 1866
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P.932 COSTS OF WAITING FOR HOSPITAL TREATMENT March 1987

SERIAL NUMBER ☐☐☐☐ REGION ☐☐

CARD SET Pink (odd) 1
White (even) 2

TIME AT START:

INTRODUCTION:

We are conducting a study for York University about choices in health care. We are interested in your experiences of the health services and your views about waiting for hospital treatment.

SECTION A

	ASK ALL		Col. Code	Skip to
1.a)	Firstly, can I check how many people live in your household altogether?		(129-30)	
	INCLUDE ALL CHILDREN	CODE NUMBER	☐☐	
b)	And, of these, how many are children under 18 years of age?	CODE NUMBER	(131-32) ☐☐	
2.a)	CODE SEX		(133)	
		Male	1	
		Female	2	
b)	What was your age last birthday?		(134)	
	CODE ONE ONLY	25-34	1	
		35-44	2	
		45-54	3	
		55-64	4	
		65-69	5	
		Under 25/70+	A →	TERMINATE INTERVIEW
c)	Are you married (or living as married) or single, widowed, divorced or separated?		(135)	
		Married	1	
		Single	2	
		Widowed	3	
		Divorced	4	
		Separated	5	
3.	Now could you think about your general state of health. Would you say that for your age it is ... READ OUT ...		(136)	
		very good,	1	
		good,	2	
		average,	3	Q.4
		below average,	4	
		or rather poor?	5	

		Col./ Code	Skip to
4.a)	ASK ALL Do you worry about your health ... READ OUT ... CODE ONE ONLY	(137)	
	... almost all the time,	1	
	quite often,	2	
	from time to time,	3	
	hardly ever,	4	
	or not at all?	5	
5.)	ASK ALL At the present time do you have a medical condition that requires you to go to the doctor or attend hospital on a regular basis? WOMEN: Please exclude pregnancy	(138)	
	Yes	1	b)
	No	2	c)
	IF YES (CODE 1 AT a)		
	b) Does this condition limit your activities ... READ OUT... CODE ONE ONLY	(139)	
	almost all the time	1	
	quite often	2	
	from time to time	3	Q. 6
	hardly ever	4	
	or not at all?	5	
	IF NO (CODE 2 AT a)		
	c) Have you ever had such a condition?	(140)	
	Yes	1	d)
	No	2	Q. 6
	IF YES (CODE 1 AT c)		
	d) How long ago was that? CODE ONE ONLY. IF MORE THAN ONE OCCASION, CODE MOST RECENT, IF OVER LONG PERIOD CODE FOR END OF ILLNESS/CONDITION.	(141)	
	Less than 5 years ago	1	
	5 years, less than 10 years	2	Q.6
	10 years less than 20 years	3	
	20 years or more	4	

		Col./ Code	Skip to
	ASK ALL THAT DO NOT LIVE ALONE (CHECK Q.1a) = 2 OR MORE OTHERWISE CODE 6	(142)	
6.a)	Do you worry about the health of anyone else in your household ... READ OUT ...		
	almost all the time,	1	
	quite often,	2	
	from time to time,	3	b)
	hardly ever,	4	
	or not at all?	5	
	(Live alone)	6	Q.7
	IF CODES 1-5 AT a)		
	b) Does anyone else in this household have a medical condition that requires them to go to the doctor or attend hospital on a regular basis?	(143)	
	Yes	1	b)
	EXCLUDE PREGNANCY No	2	Q.7
	IF YES (CODE 1 AT a)		
	c) Who is that? (PROBE: 'Anyone else')	(144)	
	CODE ALL THAT APPLY Spouse	1	
		(145)	
	Child	2	
		(146)	
	Parent/in law	3	
		(147)	
	Other (SPECIFY) _____	4	

7. During the last year, that is since March/April 1986, which of the following forms of medical care have you had? (WOMEN: Please exlude care related to childbirth)

READ OUT EACH BELOW AND CODE; FOR EACH 'YES' CHECK:

'Was that as an NHS Patient?'

	Yes		No		
	NHS	Other			
i) visits to or from your GP	1	2	3	(148)	
ii) dental treatment	1	2	3	(149)	
iii) treatment at the casualty department of a hospital	1	2	3	(150)	
iv) treatment as an out-patient at a hospital	1	2	3	(151)	Q.8

		Col./ Code	Skip to
	ASK ALL		
8.a)	And in the last three years, that is since March/April 1984, have you been in hospital as an inpatient for treatment, surgery or tests?	(152)	
	Yes	1	b)
	No	2	d)
	EXCLUDE CHILDBIRTH INCLUDE DAY-PATIENT TREATMENT IN A DAY-WARD		
	IF YES (CODE 1 AT a)	(153)	
	b) Was that as an NHS patient?		
	Yes, NHS	1	c)
	No, other	2	c)
	IF MORE THAN ONE STAY, CODE FOR MOST RECENT		
	c) How many separate stays in hospital as an inpatient (or daypatient) have you had since March/April 1984? CODE NUMBER:	(154-55)	Q.9
	IF HAVE NOT HAD HOSPITAL STAY IN LAST 3 YEARS (CODE 2 AT a)	(156)	
	d) Have you had an inpatient (or daypatient) stay in hospital in the last ten years?		
	Yes	1	Q.15
	No	2	Q.15
	IF MOST RECENT STAY NOT NHS (CODE 2 AT Q.8b) RING CODE 01 ASK ALL WHO HAVE HAD NHS HOSPITAL STAY IN LAST 3 YEARS (CODE 1 AT Q.8b)		
	SHOW CARD A		
9.	Thinking about your most recent time in hospital, how long was it from when you were first told you would have to go into hospital until the time you were actually admitted?	(157-58)	
	CODE ONE ONLY		
	(Treated as private patient)	01	Q.15
	Admitted in emergency	02	Q.15
	Less than 1 month	03	Q.10
	1 month, less than 3 months	04	Q.10
	3 months, less than 6 months	05	Q.10
	6 months, less than 1 year	06	Q.10
	1 year, less than 2 years	07	Q.10
	2 years or more	08	Q.10
	(You chose to wait)	09	Q.15
	(Can't remember)	98	Q.15
	ALL WHO WAITED FOR TREATMENT (CODES 03 - 08 AT Q.9)	(159)	
10.a)	When you were first told you would have to be admitted to hospital were you told how long you were likely to have to wait?		
	Yes	1	b)
	No	2	Q.11
	IF YES (CODE 1 AT a)	(160)	
b)	How long were you told?		
	CODE ONE ONLY		
	Less than 1 month	1	Q.11
	1 month, less than 3 months	2	Q.11
	3 months, less than 6 months	3	Q.11
	6 months, less than 1 year	4	Q.11
	1 year, less than 2 years	5	Q.11
	(Can't remember)	8	Q.11

		Col./ Code	Skip to
	ASK ALL WHO WAITED FOR TREATMENT (CODES 03-08 AT Q9)		
11.a)	Were you told your exact date of admission quite soon after you knew you had to have the treatment, or was it some time before you were given an exact date?	(161)	
	Given exact date in advance	1	Q.12
	Had to wait some time	2	b)
	IF HAD TO WAIT (CODE 2 at a)		
	b) Did the uncertainty about when you would go in make you anxious at all while you were waiting?	(162)	
	Yes	1	c)
	No	2	Q.12
	IF YES (CODE 1 at b)	(163)	
	c) Were you...READ OUT... very anxious,	1	Q.12
	fairly anxious	2	
	or just a little anxious	3	
12.a)	During the period that you were waiting to be admitted to hospital, were you in any pain at all?	(164)	
	Yes	1	b)
	No	2	Q.13
	IF YES (CODE 1 AT a)		
	b) Was this pain fairly constant or did it only affect you from time to time?	(165)	
	Fairly constant	1	Q.13
	Time to time	2	
13.a)	While you were waiting were you at all anxious about the hospital treatment itself?	(166)	
	Yes	1	b)
	No	2	Q.14
	IF YES (CODE 1 At a)	(167)	
	b) Was that ... READ OUT ... for most of the time you were waiting,	1	Q.14
	from time to time,	2	
	or only just before you were due to have the treatment?	3	

		Col./ Code	Skip to
	ASK ALL WHO WAITED FOR TREATMENT (CODES 03 -08 AT Q.9)		
14.a)	And while you were waiting, were you anxious at all about what your health might be after your hospital treatment?	(168)	
	Yes	1	b)
	No	2	Q.15
	IF YES (CODE 1 at a)		
	b) Were you ... READ OUT ...	(169)	
	very anxious,	1	
	fairly anxious,	2	
	or just a little anxious?	3	
15.	ASK ALL		
	Now thinking about members of your family and close friends. During the last year, that is, since March/April 1986, has anyone close to you been in hospital as an inpatient (or daypatient?) Do not include stays related to childbirth.	(170)	
	Yes	1	b)
	No	2	Q.16
	IF YES (CODE 1 AT a)		
	b) Who has been in hospital in the last year? PROBE: Anyone else? CODE ALL THAT APPLY		
	Spouse or partner	(171) 1	
	Parent (inc. in-law)	(172) 2	
	Own child	(173) 3	
	Other child	(174) 4	
	Other relative	(175) 5	
	Other/Non-relative	(176) 6	
	c) Did any of these people go into hospital privately (including privately within an NHS hospital)?	(177)	
	Yes	1	Q.16
	No	2	

		Col./ Code	Skip to
	ASK ALL		
16.a)	Can I just check: are you currently ... READ OUT i) - iii). and CODE:	Yes / No	Col.
	i) Waiting for a bed for an inpatient stay as an NHS patient	1 / 2	(178)
	ii) Waiting to get an outpatient appointment for diagnosis or tests as an NHS patient	1 / 2	(179)
	iii) Waiting to begin a course of treatment at a hospital outpatient department as an NHS patient?	1 / 2	(180)
	IF ANY YES (CODE 1 at ai) ii) or iii)		
	b) How long have you been waiting?	CARD 02 (207)	
	IF MORE THAN ONE YES AT a), CODE LONGEST WAIT — Less than a month,	1	
	1 month less than 3 months,	2	
	3 months, less than 6 months,	3	
	6 months, less than 1 year,	4	
	1 year, less than 2 years,	5	
	2 years or more?	6	
17.	Are you currently booked for any inpatient or outpatient medical care as a private patient?	(208)	
	Yes	1	
	No	2	SECTION B.

SECTION B

ASK ALL
READ OUT

18. *We'd like you to imagine yourself in the following situation. As I'll be asking you to make some choices based on the situation, please stop me if there's anything you don't understand.*

Imagine you are in the same general situation as you are in now. You have the same family circumstances, the same general state of health, and the same income and savings. However, you have just been diagnosed as having a medical condition for which you will need treatment in hospital. This condition is not dangerous and will not affect your future health, and once you have the treatment your health will be back to normal. However, until you get treatment your condition will mean that you'll be in moderate pain and may often feel 'under the weather'. You will have to take a few days off from your normal day-to-day work each month; will be able to do less around the house and may also have to cut down on your usual leisure and social activities. There is a hospital waiting list for the treatment you require.

In this situation you have to choose between two options, Option A and Option B.

FOR OPTION A *You will have to wait for treatment, but you do not have to pay anything. You will either be told a definite date when you will be admitted to hospital (for example, say, in exactly 5 months time) or you will be told only the earliest possible date and the latest possible date on which you could be admitted (for example between 4 months time and 6 months time - in practice you could be admitted at any time between these 2 dates.)*

FOR OPTION B *You will have to pay a certain amount of money but then you can go into hospital as soon as you want. If you have medical insurance you would not be able to use it on this occasion.*

Whichever option you choose, you will get the same treatment and the same nursing care in the same NHS hospital. The two options do not represent a choice between public and private care, but rather a choice between waiting, or paying in order to avoid the wait. If you are able and willing to borrow the money for Option B, you may do so.

The options are written on this card:

SHOW CARD B

RESPONDENT READS CARD

READ OUT

Is there anything that is not clear? IF NO PROBLEM, CONTINUE.

Now keeping in mind that you have the type of medical condition I just described, I'm going to ask you to choose between Option A and Option B using a set of cards. On each card is, firstly, the amount of time you would have to wait under Option A and whether or not you would be given a definite date of admission, and secondly the amount of money you would have to pay to get immediate admission for Option B.

SECTION B;CONTD.

Col./ Code	Skip to

Here is an example:

SHOW CARD C: READ OUT

So for Option A you will have to wait between three and 5 months for treatment.

For Option B you can go in whenever you like but must pay a sum equal to your normal household income for a week.

Which option would you choose?

RESPONDENT MAKES CHOICE

IF ANY UNCERTAINTY APPARENT: *Can I just check, you mean you would/ wouldn't be prepared to pay a week's income to avoid a wait of between 3 and 5 months if you had the type of medical condition I described?*

(209)

RING WHICH SET OF CARDS TO BE USED : Pink 1

DOUBLE CHECK AGAINST PAGE 1 AND THE CARD COLOUR White 2

SHUFFLE SET OF TRADE OFF CARDS. HAND FIRST CARD TO RESPONDENT.

READ OUT

So please look at the cards and tell me in each case which option you would choose. Make your choice based on your current income and family circumstances. Remember that whatever the amount of money or time on the card, the medical condition you have is exactly the same in each case.

WHEN CHOICE IS MADE TAKE CARD BACK, CHECK CARD NUMBER AND CODE CHOICE.
HAND NEXT CARD AND REPEAT UNTIL ALL 14 CARDS SEEN AND CODED.

CARD NUMBER	A	B	
1	1	2	(210)
2	1	2	(211)
3	1	2	(212)
4	1	2	(213)
5	1	2	(214)
6	1	2	(215)
7	1	2	(216)
8	1	2	(217)
9	1	2	(218)
10	1	2	(219)
11	1	2	(220)
12	1	2	(221)
13	1	2	(222)
14	1	2	(223)

Q.19

		Col./ Code	Skip to
19.	ASK ALL Now still imagining you had the medical condition I described, if you were told you'd have to wait six months before you could go into hospital, what is the most money you would be prepared to pay to avoid this wait? ENTER AMOUNT TO NEAREST £ ☐☐☐☐ None/Not prepared to pay 0000	(224-27)	
20.	If you were told you would have to pay £300 to get immediate admission and that otherwise you would have to wait, what's the longest time you would be prepared to wait to avoid paying the £300? ENTER IN MONTHS OR WEEKS ☐☐ MONTHS ☐☐ WEEKS	(228-30) OUO ☐☐☐	
	Couldn't pay anything	96	
	Wouldn't pay anything	97	
	Don't know	98	
21.a)	When you made all these choices did you have a specific illness or condition in mind?	(231)	
	Yes	1	b)
	No	2	SECTION C: p11
	IF YES (CODE 1 AT a) b) What was that? WRITE IN _____ _____		SECTION C: p11

SECTION C

		Col./ Code	Skip to
	ASK ALL I would now like to ask you some questions about your experience of private health insurance, that is an insurance policy that covers you for private medical treatment (for example BUPA, PPP, WPA?) (IF UNCLEAR TO RESPONDENT, EXPLAIN: You pay an annual premium to a company and you then can obtain private medical care at no charge during that year, should you need it.)		
22a)	Is anyone in your immediate household covered by an insurance policy of this kind?	(232)	
	Yes	1	b)
	No	2	Q.24
	(Don't know)	8	Q.24
	IF YES (CODE 1 AT a)		
	b) Who is covered by such a policy? CODE ONE ONLY	(233)	
	Self only	1	Q.23
	Self and spouse/partner	2	Q.23
	Self, spouse/partner and children	3	Q.23
	Spouse/partner only	4	c)
	Spouse and children only	5	c)
	Self and parent(s)	6	Q.23
	Parent(s) only	7	Q.24
	Other person(s) _____	8	Q.24
	IF SPOUSE COVERED, BUT RESPONDENT NOT (CODES 4 OR 5 AT b)		
	c) Who pays the premium for that policy? CODE ONE ONLY	(234)	
	Self	1	d)
	Partner	2	d)
	Self and partner jointly	3	d)
	Partner's employer pays part, you (and/or your partner) pay part	4	d)
	Partner's employer pays all	5	d)
	Other person	6	d)
	d) Why are you not covered by the policy?	(235)	
	Company covers employee only, would have to pay for self	1	Q.24
	Other reasons (SPECIFY) _____	2	Q.24

		Col./ Code	Skip to
	ALL WHO ARE COVERED BY A POLICY (CODE 1-3 OR 6 AT Q.22b)		
	SHOW CARD D		
23.	Who pays the premium for that policy?	(236)	
	Self	1	SECTION C1:p.13
	Partner	2	
	Self and partner jointly	3	
	Own employer (or spouse's employer pays part), you (and/or your partner) pays part	4	SECTION C2:p.15
	Own employer (or partner's employer) pays all	5	
	Other person(SPECIFY_____)	6	Q.24
	IF DO NOT HAVE POLICY THAT COVERS SELF (OR OTHER PERSON PAYS) (CODE 2 OR 8 AT Q.22a) OR CODE 4, 5, 7, 8 AT Q.22b OR CODE 6 AT Q.23)		
24a)	Have you ever been covered by a private health insurance policy which you paid for yourself(ves), either wholly or in part?	(237)	
	Yes	1	b)
	No	2	Q.25
	IF YES (CODE 1 AT a)		
	b) Why do you no longer have the policy? PROBE FULLY, RECORD VERBATIM.		
	c) And have you (and/or your partner) considered taking out such a policy again?	(238)	
	Yes	1	SECTION C3:p.18
	No	2	SECTION C4:p.21
25.	Have you (and your partner) ever seriously considered taking out a private health insurance policy yourself(ves)?	(239)	
	Yes	1	SECTION C3:p.18
	No	2	SECTION C4:p.21

		Col./ Code	Skip to
	SECTION C1		
	ALL THOSE WHO HAVE NON-COMPANY COVER PHI (CODES 1, 2, 3 AT Q.23)		
26.	For how many years have you held your current health insurance policy? CODE TO NEAREST YEAR. IF LESS THAN SIX MONTHS CODE 00 YEARS	(240-41)	
	SHOW CARD E		
27a)	Here is a list of factors that may or may not have been important in your decision to take out the policy . Which three of these factors were the most important to you? Just tell me the numbers on the card.	(242-47)	
	CODE THE THREE THAT APPLY		
	The state of your own health at the time	01	
	The health of your partner and/or children at the time	02	
	The expected health of yourself, your partner or your children in the future	03	
	Having a choice of hospital	04	
	Having a choice of consultant	05	
	The comforts of private hospitals	06	
	The possibility of getting more information about your treatment	07	
	The quality of medical treatment at private hospitals	08	
	The quality of medical treatment at NHS hospitals	09	
	Being able to choose a time to go into hospital	10	
	Being able to avoid having to wait for treatment	11	
b)	Were there any other reasons, not on the card, that were important in your decision to take out the policy?	(248)	
	Yes	1	c)
	No	2	Q.28
	IF YES (CODE 1 AT b)		
	c) What were they? PROBE FULLY; RECORD VERBATIM.		Q.28

		Col./ Code	Skip to
	SECTION C1: NON-COMPANY COVER (CONTD)		
28a)	Do you think you will continue to take out private health insurance for the rest of your life or might you give it up at some time?	(249)	
	CODE ONE ONLY — Plan to keep for life	1	d)
	May give up at some time	2	
	Don't know/It depends	3	b)
	(Will not renew subscription next time)	4	
	IF CODES 2-4 AT a)		
	b) When might you stop taking out health insurance? PROBE FULLY; RECORD VERBATIM		
	c) And why would you stop then? PROBE FULLY IF NOT COVERED AT b; RECORD VERBATIM.		
	IF PLAN TO KEEP (CODE 1 AT a)		Q.29
	d) Why do you plan to keep taking out health insurance for life? PROBE FULLY; RECORD VERBATIM		
			Q.29
	ASK ALL WITH NON-COMPANY COVER	(250)	
29a)	As an alternative to paying for a private health insurance policy each year, would you ever consider just paying for private medical care if and when you needed it? — Yes	1	
	No	2	b)
	Don't know/It depends	3	
b)	Why do you say that? PROBE FULLY; RECORD VERBATIM		
			SECTION D:p.22

SECTION C2

		Col./ Code	Skip to
	ALL THOSE WHO HAVE COMPANY COVER PHI (CODES 4 OR 5 AT Q.23)		
30.	Before you were covered by your (spouse's) employer, did you ever pay for private health insurance yourself(ves)?	(251)	
	Yes	1	Q.31
	No	2	
31a)	If you present cover were to stop for any reason, would you seriously consider paying for a policy yourself?	(252)	
	Yes	1	Q.32
	No	2	b)
	IF NO (CODE 2 AT a)		
	b) For what reasons would you not consider paying for health insurance? PROBE FULLY; RECORD VERBATIM.		
	c) You've said you would not consider paying for a private health insurance policy where you pay an annual premium. Would you ever consider just paying for private medical care if and when you needed it?	(253)	
	Yes	1	
	No	2	d)
	It depends/Don't know	3	
	d) Why do you say that? PROBE FULLY; RECORD VERBATIM		
			SECTION D: P.22

		Col./ Code	Skip to
	SECTION C2: COMPANY COVER (CONTD)		
	IF WOULD CONSIDER PAYING (CODE 1 AT Q.31a)	(254)	
32.	Would you consider taking out a policy to cover ... READ OUT ... ... yourself only,	1	
	yourself and your partner,	2	Q.33
	or yourself, your partner and your children?	3	
	Other: PLEASE STATE:_____	4	
	SHOW CARD E		
33a)	Listed on this card are factors which may or may not be important should you consider taking out your own private health insurance policy. Which three factors do you think would be of most importance to you?	(255-60)	
	CODE THE THREE THAT APPLY — The state of your own health at the time	01	
	The health of your partner and/or children at the time	02	
	The expected health of yourself, your partner or your children in the future	03	
	Having a choice of hospital	04	
	Having a choice of consultant	05	
	The comforts of private hospitals	06	
	The possibility of getting more information about your treatment	07	
	The quality of medical treatment in private hospitals	08	
	The quality of medical treatment at NHS hospitals	09	
	Being able to choose a time to go into hospital	10	
	Being able to avoid having to wait for treatment	11	
b)	Are there any other reasons, not on the card, why you would consider taking out private health insurance yourself?	(261)	
	Yes	1	c)
	No	2	Q.34
	IF YES (CODE 1 AT b)		
	c) What are those reasons? PROBE FULLY; RECORD VERBATIM		Q.34

		Col./ Code	Skip to
	SECTION C2: COMPANY COVER (CONTD): ALL CODE 1 AT Q31a)		
34a)	Are there any reasons why you would not take out private health insurance?	(262)	
	Yes	1	b)
	No	2	Q.35
	IF YES (CODE 1 AT a)		
	b) What are those reasons? RECORD FULLY; RECORD VERBATIM		
			Q.35
35a)	As an alternative to paying for a private health insurance policy each year, would you ever consider just paying for private medical care if and when you needed it?	(263)	
	Yes	1	b)
	No	2	
	Don't know/It depends	3	
b)	Why do you say that? PROBE FULLY ; RECORD VERBATIM		
			SECTION D: p 22

		Col./ Code	Skip to
	SECTION C3		
	ALL THOSE WHO SERIOUSLY CONSIDERED PHI (CODE 1 AT Q.24c OR CODE 1 AT Q.25)	(264)	
36.	When did you first consider taking out a health insurance policy? CODE ONE ONLY		
	Within the last year	1	
	1 year, less than 3 years	2	
	3 years, less than 5 years	3	
	5 years, less than 10 years	4	
	More than 10 years ago	5	
37.	Did you consider taking out the policy to cover ... READ OUT ...	(265)	
	yourself only,	1	Q.38
	yourself and your partner,	2	
	or yourself, your partner and children?	3	
	Other PLEASE STATE _____	4	
	SHOW CARD E		
38a)	Listed on this card are factors which may or may not have been important when you've considered private health insurance? Which three factors have been most important to you?	(266-71)	
	CODE THE THREE THAT APPLY		
	The state of your own health at the time	01	b)
	The health of your partner and/or children at the time	02	
	The expected health of yourself, your partner or your children in the future	03	
	Having a choice of hospital	04	
	Having a choice of consultant	05	
	The comforts of private hospitals	06	
	The possibility of getting more information about your treatment in the private sector	07	
	The quality of medical treatment in the private sector	08	
	The quality of medical treatment at NHS hospitals	09	
	Being able to choose a convenient time to go into hospital	10	
	Being able to avoid a wait for treatment	11	

		Col./ Code	Skip to
	Question 38 contd.		
b)	Have there been any other reasons, not listed on the card, why you've been considering private health insurance?	(272)	
	Yes	1	c)
	No	2	Q.39
	IF YES (CODE 1 At b)		
	c) What are those reasons? PROBE FULLY. RECORD VERBATIM.		
39.	Why haven't you taken out a policy at the present time? PROBE FULLY. RECORD VERBATIM		Q.40

		Col./ Code	Skip to
40a)	Do you think it is likely that you will take out a policy in the future?	(273)	
	Yes	1	b)
	No	2	Q.41
	IF YES (CODE 1 AT a)		
	b) Once you've taken out the policy, for how long do you think you would keep it? PROBE FULLY; RECORD VERBATIM.		
41a)	As an alternative to paying for a private health insurance policy each year would you ever consider just paying for private medical care if and when you needed it?	(274)	
	Yes	1	
	No	2	b)
	Don't know/It depends	3	
b)	Why do you say that? PROBE FULLY. RECORD VERBATIM.		
			SECTION D: p.22

SECTION C4

		Col./ Code	Skip to
	ALL THOSE WHO HAVE NOT CONSIDERED PHI (CODE 2 At Q.24c OR AT Q.25)		
42.	Why is it that you haven't seriously considered taking out private health insurance? PROBE FULLY; RECORD VERBATIM		
43a)	Do you think you might consider taking out a policy in the future?	(275)	
	Yes	1	b)
	No	2	Q.44
	IF YES (CODE 1 At a)		
	b) When do you think this would be? PROBE FULLY; RECORD VERBATIM.		
	c) Why would you consider taking out a policy then? PROBE FULLY (if not covered at b); RECORD VERBATIM		
44a)	You've said you (currently) would not consider taking out a private health insurance policy for which you paid an annual premium. Would you ever consider just paying for private medical care if and when you needed it?	(276)	
	Yes	1	
	No	2	b)
	It depends/DK	3	
b)	Why do you say that? PROBE FULLY; RECORD VERBATIM		
			SECTION D:p.22

		Col./ Code	Skip to
	SECTION D ASK ALL		
	SHOW CARD F		
45.	Which of the views on this card comes closest to your own views about private medical treatment in hospitals?	(277)	
	Private medical treatment in all hospitals should be abolished	1	
	Private medical treatment should be allowed in private hospitals but not in National Health Service hospitals	2	
	Private medical treatment should be allowed in both private and National Health Service hospitals	3	
	(Don't know)	8	
	Finally, a few questions about you and your household.	(278)	
46a).	In whose name is this accommodation owned or rented?		
	Respondent and/or spouse	1	b)
	Other person	2	c)
	IF 'RESPONDENT OR SPOUSE' (CODE 1 AT a)		
	b) Do you own or rent this accommodation?	(279)	
	IF OTHER PERSON		
	c) Does (responsible person) own or rent it?		
	Owned (include buying)	1	
	Rented - Local Authority	2	
	- Housing Association	3	Q.47
	- Private landlord	4	
	Other (SPECIFY) _____	5	
		(280) SPARE	
		CARD 03	
47.	How old were you when you left school?	(307-08)	
	(Never went to school)	01	
	NB. INCLUDE SCHOOL OR SIXTH FORM COLLEGE NOT ANY FURTHER OR HIGHER EDUCATION.	CODE AGE IN YEARS	Q.48

		Col./ Code	Skip to
48a)	Do you have any qualification obtained either at school or after leaving school?	(309)	
	Yes	1	b)
	No	2	Q.49
	IF YES (CODE 1 AT a)		
	SHOW CARD G		
	b) Which of the qualifications on this card is the highest qualification you have obtained.	(310-311)	
	CODE ONE ONLY		
	CSE	01	
	'O' Level/School Certificate or Matriculation/ Scottish SCE/SUPE/SLC Lower or ordinary	02	
	City and Guilds/ONC/OND/BTEC/ Certificate of Sixth Year Studies	03	
	'A' or 'S' Level Higher School Certificate/ Scottish SCE/SUPE/SLC Higher	04	
	HNC/HND/Dip HE	05	
	Professional/Teaching/Nursing qualification without a degree/University Certificate or Diploma	06	
	Univeristy or CNAA degree	07	
	Masters/Doctorate/Postgraduate professional qualification (eg. CQSW,PGCE);	08	
	(OTHER NOT LISTED _____)	09	
	ASK ALL	(312-13)	
49a)	Can I just check, at the present time are you in paid work or doing something else?		
	PROBE AS NECESSARY CODE ONE ONLY		
	In work (including government schemes)		
	Full time (30+ hours) employee	01	Q.50
	Part-time (less than 30 hours) employee	02	
	Full-time self employed (30+ hours)	03	
	Part-time (less than 30 hrs) self-employed	04	
	Not in work		
	Waiting to start, obtained job	05	Q.53
	Looking for work	06	
	Long term sickness	07	
	Full-time student	08	
	Wholly retired	09	
	Keeping house	10	
	Doing something else	11	
	PLEASE SPECIFY _____		
	IF IN WORK (CODES 01-04 AT Q.49)	(314)	
50.	Approximately how many people are employed at your place or work?		
	11-25	1	Q.51
	25-100	2	
	100 or more	3	

		Col./ Code	Skip to
	IF IN WORK (CODES 01-04 AT Q.49a)	(315-16)	
51.	How many hours do you work on average each week, including any overtime you may do? CODE HOURS		
	IF 'IN WORK' CODES 01-04 AT Q.49a)	(317)	
52.	If you were unable to work because of illness, after what time would your income/earnings be affected? CODE ONE ONLY		
	Less than 1 week	1	
	1 week, less than 3 weeks	2	
	3 weeks, less than 4 weeks	3	
	4 weeks, less than 3 months	4	Q.53
	3 months less than 6 months	5	
	6 months or more	6	
	(Don't know)	8	
	Never/not at all	7	
	ASK ALL SHOW CARD H		
53a)	Finally, which of the amounts on this card comes closest to your personal total gross income - I mean income from all sources before tax and other deductions? Just say which code number in the middle applies.	(318-19)	
	CODE		
	HOUSEWIVES WITH NO INCOME OF THEIR OWN SHOULD BE CODED AS NONE ENTER OR CODE:		
	None	96	
	Refused	97	
	Don't know	98	
	IF HAS SPOUSE/PARTNER		
b)	And which of the amounts on this card comes closest to you and your spouse/partner's total joint gross income - again income from all sources before tax and other deductions.	(320-21)	
	CODE		
	ENTER OR CODE:		
	None	96	
	Refused	97	
	Don't know	98	END
	TIME AT END OF INTERVIEW [ ][ ][ ][ ]	(322-80)	
	LENGTH OF INTERVIEW [ ][ ] MINS.		
	INTERVIEWER NAME _____		
	INTERVIEWER NO. _____		

P.932 CARD A Q.9

Admitted in an emergency
Less than 1 month
1 month, less than 3 months
3 months, less than 6 months
6 months, less than 1 year
1 year, less than 2 years
2 years or more

P.932 CARD B

OPTION A

- Wait for treatment
- May or may not get definite date for admission
- Pay nothing

OPTION B

- Get treatment as soon as you like
- Can choose a date that suits you
- Pay a sum of money.(Cannot use private health insurance)

FOR BOTH OPTIONS

- Treatment the same
- Hospital the same

P.932 CARD C

EXAMPLE

OPTION A	OPTION B
No definite date of admission: wait 3-5 months	Pay: your household income for one week.

P.932 CARD D Q.23

Yourself

Your partner

Yourself and your partner jointly

Your own employer (or partner's employer) pays part, you (or your partner) pay part

Your own employer (or partner's employer) pays all

Other person

Stated Preference Cards: White Set

1.	Option A	Option B
	No definite date of admission	Pay £100
	Wait 3 - 5 months	
2.	Option A	Option B
	No definite date of admission	Pay £100
	Wait 5 - 7 months	
3.	Option A	Option B
	Definite date of admission	Pay £100
	Wait exactly 12 months	
4.	Option A	Option B
	Definite date of admission	Pay £200
	Wait exactly 4 months	
5.	Option A	Option B
	No definite date of admission	Pay £200
	Wait 5 - 7 months	
6.	Option A	Option B
	No definite date of admission	Pay £400
	Wait 3 - 5 months	
7.	Option A	Option B
	Definite date of admission	Pay £400
	Wait exactly 6 months	

8.	Option A	Option B
	No definite date of admission	Pay £400
	Wait 11 - 13 months	
9.	Option A	Option B
	Definite date of admission	Pay £800
	Wait exactly 4 months	
10.	Option A	Option B
	Definite date of admission	Pay £50
	Wait exactly 6 months	
11.	Option A	Option B
	No definite date of admission	Pay £770
	Wait 10 - 12 months	
12.	Option A	Option B
	No definite date of admission	Pay £75
	Wait 1 - 3 months	
13.	Option A	Option B
	Definite date of admission	Pay £160
	Wait exactly 5 months	
14.	Option A	Option B
	Definite date of admission	Pay £530
	Wait exactly 8 months	

Stated Preference Cards: Pink Set

1.	Option A	Option B
	No definite date of admission	Pay £75
	Wait 2 - 4 months	
2.	Option A	Option B
	No definite date of admission	Pay £75
	Wait 4 - 6 months	
3.	Option A	Option B
	Definite date of admission	Pay £75
	Wait exactly 9 months	
4.	Option A	Option B
	Definite date of admission	Pay £150
	Wait exactly 3 months	
5.	Option A	Option B
	No definite date of admission	Pay £150
	Wait 4 - 6 months	
6.	Option A	Option B
	No definite date of admission	Pay £300
	Wait 2 - 4 months	
7.	Option A	Option B
	Definite date of admission	Pay £300
	Wait exactly 5 months	

8. Option A

No definite date of admission

Wait 8 - 10 months

Option B

Pay £300

9. Option A

Definite date of admission

Wait exactly 4 months

Option B

Pay £800

10. Option A

Definite date of admission

Wait exactly 6 months

Option B

Pay £50

11. Option A

No definite date of admission

Wait 10 - 12 months

Option B

Pay £770

12. Option A

No definite date of admission

Wait 5 - 7 months

Option B

Pay £600

13. Option A

Definite date of admission

Wait exactly 4 months

Option B

Pay £160

14. Option A

Definite date of admission

Wait exactly 12 months

Option B

Pay £480

P.932

CARD E

1. The state of your own health at the time
2. The health of your partner and/or children at the time
3. The expected health of yourself, your partner or your children in the future
4. Having a choice of hospital
5. Having a choice of consultant
6. The comforts of private hospitals
7. The possibility of getting more information about your treatment in the private sector
8. The quality of medical treatment at private hospitals
9. The quality of medical treatment at NHS hospitals
10. Being able to choose a convenient time to go into hospital
11. Being able to avoid having to wait for treatment

P.932 Q.45

CARD F

Private medical treatment in all hospitals should be abolished

Private medical treatment should be allowed in private hospitals but not in National Health Service hospitals

Private medical treatment should be allowed in both private and National Health Service hospitals

P.932 CARD G Q.48

CSE

'O' Level/Scottish SCE, SUPE, SLC Lower/School Certificate

City and Guilds

ONC/OND/BTEC

'A' or 'S' Level/Scottish SCE, SUPE, SLC Higher/ Higher School Certificate

HNC/HND/Dip HE

Professional, nursing or teaching qualification without a degree

University Certificate or Diploma

University or CNAA degree

Masters

Doctorate

Postgraduate professional qualification

P.932 CARD H Q.53

WEEKLY	Code	ANNUAL
Under £50	04	Under £2,500
£50 - £74	08	£2,500 - £3,899
£75 - £99	01	£3,900 - £5,199
£100 - £149	07	£5,200 - £7,799
£150 - £199	02	£7,800 - £10,399
£200 - £249	03	£10,400 - £12,999
£250 - £349	06	£13,000 - £18,199
£350 - £449	05	£18,200 - £23,399
£450 - £599	10	£23,400 - £31,199
£600 or over	09	£31,200 or over