

USING DISCRETE CHOICE EXPERIMENTS TO VALUE
HEALTH AND HEALTH CARE

THE ECONOMICS OF NON-MARKET GOODS AND RESOURCES

VOLUME 11

Series Editor: Dr. Ian J. Bateman

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Aims and Scope

The volumes which comprise *The Economics of Non-Market Goods and Resources* series have been specially commissioned to bring a new perspective to the greatest economic challenge facing society in the 21st Century; the successful incorporation of non-market goods within economic decision making. Only by addressing the complexity of the underlying issues raised by such a task can society hope to redirect global economies onto paths of sustainable development. To this end the series combines and contrasts perspectives from environmental, ecological and resource economics and contains a variety of volumes which will appeal to students, researchers, and decision makers at a range of expertise levels. The series will initially address two themes, the first examining the ways in which economists assess the value of non-market goods, the second looking at approaches to the sustainable use and management of such goods. These will be supplemented with further texts examining the fundamental theoretical and applied problems raised by public good decision making.

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Using Discrete Choice Experiments to Value Health and Health Care

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PREFACE

USING DISCRETE CHOICE EXPERIMENTS TO VALUE HEALTH AND HEALTH CARE

In recent years, there has been a growing interest in the development and application of discrete choice experiments (DCEs) within health economics. The use of this relatively new instrument to value health and health care has now evolved to the point where a general text for practising professionals seems appropriate. The few existing books in this area are either research monographs or focus almost entirely on more advanced topics. By contrast, this book serves as a general reference for those applying the technique to health care for the first time as well as for more experienced practitioners. Thus, the book is relevant to postgraduate students and applied researchers who have an interest in the use of DCEs for valuing health and health care. Contributions are made by a number of leading experts in the field, enabling the book to contain a uniquely rich mix of research applications and methodological developments.

Part 1 summarises how DCEs can be implemented, from experimental design to data analysis and the interpretation of results. In many ways, this can be regarded as a *crash* course on the conduct of DCEs. Extensive reference is made throughout to other sources of literature where the interested reader can find further details. Part 2 presents a series of case studies, illustrating the breadth of applications in health economics. Part 3 describes some key methodological issues that have been addressed in the application of DCEs in health. Part 4 concludes with an overview of research issues discussed which we believe are at the leading edge of this field.

It is important to acknowledge that any book requires hard work by a large number of people – this one is no exception. We would like to thank all contributing authors for agreeing to participate in this endeavour. We also owe thanks to many individuals who reviewed drafts, suggested resource materials and, in general, gave us necessary support to complete this book. In particular, we acknowledge with special thanks and appreciation the contributions of Barbara Eberth, Verity Watson, Heather Mackintosh and Esther Verdries. We also owe thanks to Ian Bateman for his kind invitation to contribute to the Springer series and for his support throughout the project.

The editors are also grateful for financial support from the Chief Scientist Office of the Scottish Executive Health Department, the University of Aberdeen and the University of Southampton.

Despite the debt owed to our colleagues, the editors and authors are solely responsible for any erroneous interpretation or misuse of data. We accept full responsibility for the final version of the text and sincerely hope that the fruit of these efforts is a book that is both useful and informative. If there are any comments about this book, the editors would be delighted to hear from you. Please email one of us at the addresses below.

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The Editors

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INTRODUCTION

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1. BENEFIT VALUATION IN HEALTH ECONOMICS

Given the substantial resources devoted to health care in many countries,¹ a fundamental question is: *how does a society determine which health services to provide and the appropriate level at which to provide them?* In many countries, there is a widespread concern that the market mechanism fails to allocate health care resources appropriately. Hence, this task often falls to government.

The dramatic increase in the demand for health care over the last 40 years coupled with the finite nature of those resources (e.g. labour and capital) have led to a growing relative scarcity of health care resources and thus an increasing interest in health care choices and values. Whilst rising costs have spurred numerous cost-containment efforts by governments in the last few decades, the explicit valuation of the benefits of actions improving health care delivery is undoubtedly a crucial aspect of designing effective and efficient policies that accurately reflect the desires of society.

One way health economists can contribute to health policy is by providing explicit measures of benefit valuation for assessing alternative health care interventions. This is no small task since it is accepted that to fully assess the value of benefits in health care, researchers must estimate the value of a wide and at times complex multidimensional array of health care policies, strategies, interventions and treatments. Indeed, the valuation of health care benefits presents one of the greatest challenges facing health economics today. Therefore, it is not surprising to find that different approaches have developed over time reflecting the need to make choices in a diversity of decision contexts. The challenge also justifies the existence of an ongoing programme of research within health economics aiming to better understand the strengths and weaknesses of different methodologies in providing values for use in economic evaluation.

Full economic evaluation techniques include cost-minimisation analysis (CMA), cost-effectiveness analysis (CEA), cost-utility analysis (CUA) and cost-benefit analysis (CBA) (Drummond et al., 2005; Gold et al., 1996). For many years, the method of choice for making policy recommendations has been CEA, which measures benefits as quantity of life using unidimensional clinical measures such as life years saved or deaths averted. The 1980s and the early 1990s saw the development of CUA, which uses a measure of benefit known as “quality-adjusted life years” (QALYs), taking into account both quantity and quality of life generated by health care interventions. Over the years, the QALY measure has gained considerable prominence (Neumann et al., 2005; Stoykova and Fox-Rushby, 2005). It is seen by many health care decision makers as a panacea for priority setting and rationing when used as an input to “cost per QALY” analyses. In addition, CEA/CUA is the method for benefit valuation recommended in guidelines such as those from the National Institute for Health and Clinical Excellence (NICE) in the UK (Department of Health, NHS Executive, 1998) and those in the USA (Gold et al., 1996), Australia (Pharmaceutical Benefits Advisory Committee, 2002), China (China Pharmacoeconomics Center, 2006), the Netherlands (Ziekenfondsraad, 1999), Sweden (Sweden Pharmaceutical Benefits Board, 2003), Poland (Orlewska and Mierzejewski, 2000), Hungary (Szende et al., 2002), Spain (Rovira and Antoñanzas, 1995) and Italy (Garattini et al., 1995) to name a few.²

It follows that, unlike in other policy fields such as transportation or the environment, health care policy makers have been reluctant to embrace the valuation of benefits in monetary terms within a CBA framework. CBA presents theoretical advantages such as a firm basis in welfare economics and a common unit of measure for costs and benefits as required to determine whether a policy increases social welfare (*allocative efficiency*). Despite these advantages, most CBA studies in health economics are experimental in nature, attempting to explore measurement feasibility issues rather than being full programme evaluations (Drummond et al., 2005). This historical lack of popularity of CBA in health economics may be partly due to the perceived difficulty associated with placing monetary values on so-called intangible benefits of health care provision and partly to some ongoing conceptual debates concerning what questions should be asked of whom in health care contingent valuation studies (see, e.g. Smith, 2003). However, this view is gradually changing. Significant progress made in monetary valuation methods over the past decade (primarily in the area of environmental economics, but also within the health care arena) holds out the prospect of a move towards decision making based on monetised costs and benefits of alternative policy interventions, as encouraged in the latest HM Treasury's *Green Book* (2003). Indeed, greater use of these methods to facilitate CBA for policy recommendations in health and health care is increasingly advocated.³ Section 2 outlines the main methods of benefit assessment at the analyst's disposal.

2. MEASURING HEALTH CARE BENEFITS IN MONETARY TERMS

The assessment of health care programmes' benefits in monetary terms is a challenging task because health services are usually not traded in markets and, when they are, prices can be unrealistically low. This means that the standard market-based estimation techniques – which rely on gaining insight from people's preferences

for goods and services by reference to patterns of buying and selling – cannot be easily applied.

In their development of monetary benefit valuation techniques, economists have taken two fundamental pathways. The first draws on Samuelson's seminal article (Samuelson, 1948) and involves the exploration of people's preferences as (indirectly) revealed through their actions (choices) in markets specifically related to the value of interest. This group of techniques is known as "revealed preference" (RP) techniques. Examples of such methods include the travel cost method and the hedonic pricing technique. More details on valuation using RP data can be found in Bockstael and McConnell (2006) and Champ et al. (2003). The alternative pathway involves asking the same individuals to state their preferences in hypothetical (or virtual) markets. The methods that follow this strategy are collectively known as "stated preference" (SP) techniques.

A healthy scepticism about relying on what consumers say they will do (SP) compared with observing what they actually do (RP) has typically been displayed in the literature. Yet, there are a number of compelling reasons why health economists should be interested in SP data. Most important in the health sector is that it may not be possible to infer consumer preferences or values from RP data.⁴ Many aspects of health care are not traded explicitly in markets, have public good characteristics and are consumed free at the point of service or heavily subsidised via health insurance. Further, an (imperfect) agency relationship exists between the supplier (the doctor or other health care provider) and the consumer (the patient), as the former will generally be better informed than the latter. This problem of *asymmetric* information, linked with the uncertain nature of both health and the outcomes of health care, means that actual decisions may not be solely (if at all) based on consumer preferences. Another reason for favouring SP techniques is that they are based on hypothetical choices that can be precisely specified in advance using a design, which allows straightforward identification of all effects of interest. This is in contrast to RP data, which cannot be controlled *a priori* so that model identification cannot be guaranteed. Further, SP methods allow large quantities of relevant data to be collected at moderate cost. Furthermore, SP data provides information on current preferences and how these are likely to respond to a proposed change in resource allocation.

As a result, research in the area of health care benefits valuation has seen an increased interest in SP approaches. More recently interest has also been shown in the potential gains from combining RP data, with typically less variability but high validity and reliability, and SP data, with more favourable statistical properties (for more on data enrichment see Chapter 10). The two best-known SP approaches for providing estimates of monetary valuation are the contingent valuation method (CVM) and discrete choice experiments (DCEs). These are outlined below.

2.1. Contingent Valuation Method

The CVM refers to a choice-based approach to value benefits where individuals are asked directly, in a survey, how much they would be willing to pay (WTP) for specific commodities. In some cases, people are asked for the amount they would be willing to accept in compensation (WTAC) to give up a specific good or

service. It is called “contingent” valuation, because people are asked to state their WTP, contingent on a particular hypothetical scenario and description of the commodity being valued. The CVM approach can be seen as a holistic approach, with a value being estimated for the good as a whole (for more details see chapter by Boyle in Champ and Welsh, 2006).

CVM is founded in neoclassical welfare economics providing a theoretically correct measure of value. However, its application presents many challenges. Most importantly, it is prone to some known biases.⁵ Biased value measures mean that either responses are under-sensitive to manipulations that should affect them (e.g. the “scope” or quantity of the goods or services being valued), or are too sensitive to what should not affect them (e.g. question format or the cost of a good or service). In addition to this, and perhaps not surprisingly within the health care field there are practical problems when asking individuals to express monetary valuations for health care; e.g. individuals may be unfamiliar with the health state under valuation or they may morally object to place a value on health.

All in all, CVM has been applied with varying degrees of success in health care both for benefit valuation and for elicitation of public views. For example, WTP values have been derived for ultrasound in pregnancy (Berwick and Weinstein, 1985) asthma medication (Barner et al., 1999), genetic testing for cancer risk (Bosompra et al., 2001) and cystic fibrosis (Donaldson et al., 1995), community water fluoridation (Dixon and Shackley, 1999) and to set priorities for public sector health care programs (Olsen and Donaldson, 1998) (See Diener et al. (1998); Klose (1999) and Smith (2003) for comprehensive reviews). As monetary benefit valuation is increasingly advocated in health care and many methodological issues become better understood, the use of CVM for valuing the multiple-dimensions of health care benefits can be expected to grow.

2.2. *Discrete Choice Experiments*

DCEs are an attribute-based approach to collect SP data. They involve presenting respondents with a sequence of hypothetical scenarios (choice sets) composed by two or more competing alternatives that vary along several attributes, one of which may be the price of the alternative or some approximation for it. In a Lancasterian framework (Lancaster, 1966), it is assumed these attribute levels determine the value (utility) of each alternative. For each choice set, respondents are asked to choose their preferred scenario. It is assumed that individuals will consider all information provided and then select the alternative with the highest utility. Responses enable the analyst to model the probability of an alternative being chosen as a function of the attributes and the socio-economic characteristics of the respondents. This allows an estimation of the relative support that respondents show for the various competing alternatives. Other policy outputs include marginal rates of substitution across non-monetary attributes as well as WTP or WTAC for an improvement or deterioration of one of those attribute welfare measures for a proposed change in levels of the attributes and predicted uptake or demand.

The DCE technique was introduced into health economics in the early 1990s to enhance benefit assessment by challenging the presumption that the goal of health services is only to improve health. Benefits can be many sided, e.g. containing

elements of the process of care as well as its outcome, and that outcome may extend beyond health benefits such as reassurance or anxiety. The underlying paradigm of the QALY measure was specifically designed to capture health outcome benefits only. Other concerns, particularly distributional ones, are dealt with by valuing a QALY equally to whoever receives it. If some of the omitted factors are valuable to patients or members of the public, the conclusions reached by policy makers may conflict with those of patients and public (Ryan, 1999). Both CVM and DCE allow for the possibility of measuring benefits beyond health outcome (at least in principle). Advocates of DCEs have argued that DCEs offer several advantages over the CVM (Louviere, 1987; Louviere et al., 1997). First, they enable researchers to collect comparable or higher-quality valuation information at a lower cost. Second, they allow researchers to characterise the incremental benefits that consumers derive from the different individual attributes of health care interventions. Third, they more completely characterise a consumer's underlying utility function, and thus may improve policy makers' ability to perform benefit transfers.⁶ Further, it is argued that this method may overcome some of the "biases" encountered in empirical applications using CVM (Hanley et al., 2001). Furthermore, WTP is to be inferred indirectly rather than explicitly pricing the good. This is highly desirable in a health care context where, as mentioned, some individuals may refuse to place a monetary value on human health in the CVM format, increasing the incidence of protest zero bids.

It should be noted that there is now consensus that the choice of SP method depends, in part, on how much detail is required on the characteristics of the health care intervention being valued. Some studies need to answer questions only about the good or service as a whole (e.g. what is the monetary value placed on a screening test). If this is the case, a CVM study is appropriate. In other contexts, what matters is the importance of different characteristics of the programme being valued. In these cases, DCEs are more useful. There are advantages and disadvantages associated with both CVM and DCEs. To the extent that DCEs also allow estimating total values, they provide more information than a single (CVM) experiment. However, this increased information comes at a price: evidence suggests that DCEs are more cognitively demanding for respondents to complete and the study outcomes might be affected (for more on this, see Chapter 9). More generally, some situations can be identified where the two valuation techniques can be used to complement each other; i.e. to increase the robustness of the data or to validate the underlying components of values. The remainder of this book is solely concerned with DCEs and its applications in health economics.

3. PURPOSE AND OUTLINE OF THE BOOK

As interest in the application of DCEs to health care issues continues to grow there is a need for a general reference book which can help to guide those applying the technique to health care for the first time, as well as those more experienced practitioners interested in the current methodological status of DCEs in health economics and debates about future challenges. The book therefore has three aims: (i) to introduce the technique in the health care context; (ii) to demonstrate the broad applicability of the technique, using a range of case studies; and (iii) to provide insight into

the methodological status of DCEs in health economics, focusing on current achievements and future challenges. It is thus anticipated that this book will become a key reference for those interested in the application of DCE to the valuation of health care policy, interventions and treatments, as well as useful in better understanding individual behaviour and predicting demand.

The book is presented in four parts. Part 1 has three chapters which together form the building blocks for the reader to understand the theory, methods and application of DCE in health economics. Chapter 1 by Amaya-Amaya et al. provides a comprehensive description of the theoretical underpinnings of DCEs. It also describes the different stages involved in the conduct of an experiment, outlining some important details that the practitioner needs to consider when developing and implementing the survey. Chapter 2 is a technical chapter by Street et al., explaining one way of constructing optimal experimental designs. This will interest the more specialist reader, at the same time giving the general reader an appreciation of what is involved and a sense of the statistical theory that underlies experimental design. Having explained the theoretical underpinnings and methods of a DCE, Chapter 3 by Ryan et al. focuses on application. It is intended for the general reader who is wants to understand some of the practical detail of using an experimental design to collect data and to prepare the data for analysis. This chapter uses a case study in the area of prenatal diagnosis to work through key steps.

Part 2 provides the reader with an appreciation of the breadth of DCE applications in health economics. There are four empirical chapters. Chapters 4–6 illustrate different aspects of using DCE to value health care interventions. Chapter 4 by Ryan et al. demonstrates the case of how misleading it can be if benefits are restricted to health outcomes only. It shows how a clinical trial reported no significant difference in clinical benefits of alternative rheumatology appointment systems, but a DCE survey identified reduced waiting times as an important (non-health) benefit to patients. Chapter 4 also considers going beyond the basic model of analysis to allow for different degrees of similarity across alternatives. Chapter 5 by Gerard et al. explores the potential of DCE to predict uptake of a screening programme under different scenarios using a simple binary choice experiment. This chapter also provides an example of alternative coding schemes for the explanatory variables included in the analysis. In Chapter 6, Bryan and Robertson show how the DCE technique can be used in the context of CUA and QALYs to learn more about priority setting rules to inform the debate around the challenge of establishing some “threshold level of cost per QALY (Raftery, 2006). Chapter 7 presents analysis from Scott et al. of an example of using DCE to understand individual behaviour in the form of job satisfaction characteristics for hospital consultants in the UK. This provides a useful exploration of public sector labour market behaviour in a climate of health professional shortages.

It is important to emphasise that these empirical studies were selected to demonstrate the breadth of application possible and not necessarily for their ability to demonstrate good practice over all the stages of undertaking and reporting a DCE. In particular, we are aware that experimental design practices have moved on considerably since these studies were initiated. Given the current state of the art in experimental design of DCE, these examples would be now regarded as *not so good* designs, but they remain appropriate for the purpose they were selected.

The focus in Part 3 is to expose the reader to some examples of methodological issues under debate in the literature. The first that is covered in Chapter 8 by Slothuus and Gryd-Hansen concerns our need to better understand how respondents interpret the price proxy attribute. This chapter considers how method of payment and willingness to engage in compensatory decision making may impact on preferences and what we can do to explore our data sets as thoroughly as possible to avoid misinterpretation of data. Chapter 9 by San Miguel Inza et al. considers the issue of rational choice in the DCE context. The authors demonstrate alternative, more extensive, tests of rationality as well as the benefit of using qualitative methods to enhance the analysts' understanding of how respondents answer DCE questions and thereby better understanding the validity of DCE responses. Chapter 10, the last methodological chapter by Mark and Swait focuses on how combining information on what individuals' say they will do (RP data) with information on what they did do (SP data) – sometimes referred to as data fusion or enrichment – can improve the analyst's understanding of preferences and the implication for future decisions. This is a cutting-edge area of research within health economics. The study described makes use of RP and SP data obtained from doctor's preferences for prescribing in the private US health care system. For health economists operating in publicly funded health care systems one challenge is to find relevant opportunities to use this technique. Whilst it may be harder to find robust RP data in these systems, the future may lie in combining different sources of SP data (e.g. DCE data on indirect WTP with contingent valuation data).

Finally, Part 4 has a single chapter which offers some concluding thoughts from the editors. They first summarise the topics covered in this book, followed by an overview of some directions for research in the future.

ENDNOTES

¹ Health care expenditures are substantial and dramatically rising in most industrialised countries. Over the last 5 years, the increase in health spending, combined with lower economic growth, has driven the share of health expenditure as a percentage of gross domestic product (GDP) up from an average 7.8% in 1997 to 8.5% in 2002 (OECD, 2005).

² For more information on some key features of these guidelines in several countries around the world, visit the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) web site: <http://www.ispor.org/PEguidelines/index.asp>.

³ See, e.g. Loomes (2002), Hanley et al. (2002) and Ryan (2004). See also Baker et al. (2003) for a recent research proposal on the determination of a monetary value for a QALY to help NICE offering guidance to the National Health Service (NHS) about the uptake (or maintenance) of an intervention.

⁴ Where this is possible, i.e. when both RP and SP data are available, the recommendation is to capitalise on the complementary strengths of each source by combining the different data sets (also referred to data fusion) (see, e.g. Hensher et al. 1999). See Chapter 10 for more on this and an application in health care.

⁵ As noted by Green and Tunstall (1999) the term "bias" is an interesting and potentially dangerous piece of economic labelling that has been used to described both theoretically unexpected and theoretically expected, both undesirable, effects. In either case, the presumption is that the results, the

respondents or the experimental methods are “wrong”, so the term has pejorative overtones. Conversely, in psychology “bias” refers to a characteristic of the experimental context that influences respondents in a particular way. Here, unexpected rather than undesirable effects are seen as a way to theoretical development. The term “bias” should therefore be used with extreme caution or indeed avoided altogether by referring to this as an “effect” (e.g. Munro and Hanley, 1999).

⁶ Benefit transfers refer to the use of existing estimates of the benefit of a non-marketed good from one or more sites (study sites) to predict the value for the same or for a similar good in a different site (policy site) – see Morrison et al. (2002).

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