Introduction

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Human behaviour is characterised by choices, long term as well as short term. Many of the choices we make have significant implications on the demand for services and infrastructure as well as the consumption of goods. The efficient functioning of society relies on the provision of sufficient supply to meet that demand. Governments and industry need to make decisions on infrastructure developments, the introduction of new services and the development and configuration of consumer products. At the policy end, there is also scope for steering demand, for example encouraging more environmentally friendly behaviour or a spreading of energy use throughout the day.

Many of these decisions concerning pricing, supply or regulation have important financial, environmental and societal implications and need to be based on an understanding of consumer preferences, notably in the form of monetary valuations, and accurate forecasts of consumer demand. At the present time, potentially more than ever before, this need for reliable valuations and forecasts of demand is of crucial importance. Indeed, in the face of great economic uncertainty, coupled with increasing environmental concerns and ongoing security threats, the prioritisation between different major infrastructure developments is especially difficult, as recent examples of new high speed rail developments or the replacement of an ageing energy infrastructure have shown in a number of countries. Similarly, major policy decisions such as changes to the welfare system need to be informed at least in part by an understanding of the likely changes in work patterns and, longer term, the education and career choices of young people. Corresponding complexities arise in the commercial area with a need to understand the demand for new products and services. At the same time, important demographic changes relating to ageing and migration are likely to have major implications on the pattern of demand for services and products and their spatial location. Finally, the very nature of human choice behaviour is changing, with increasing use of information technology, the growing influence of (virtual) social networks and the role of societal and peer pressure, also in the context of various governments’ nudge agendas.

Mathematical models of consumer choice play a key role in the process of understanding and predicting behaviour and are also used around the world to produce estimates of the valuations of services, environmental goods and product components. Their use in practice is truly multidisciplinary and while transport may still be the biggest area of activity, there exists a huge variety of applications in fields as diverse as energy, communications, health and a number of environmental areas.

The methods used in these real-world applications largely have their source in academia, notwithstanding theoretical developments by leading practitioners. The academic community of choice modellers is vibrant and similarly cross-disciplinary as the real-world applications; in fact, it is researchers outside, for example, the transport and marketing disciplines that are driving the increasing use of choice models in new areas. Academic work in choice modelling is also evolving and recognising the real-world
changes to behaviour, for example, through improved representation of social networks and the role of soft factors such as attitudes and perceptions. Despite the exciting breadth of activity taking place in academia, it is also important to recognise that there is still a lack of transition of advanced methods from academia into practice and, as a community, choice modellers have a responsibility to better illustrate the advantages of their developments in real-world work and to make their methods more practical.

While this volume refers largely to developments in a microeconomic context, a large number of researchers in fields such as behavioural economics and mathematical psychology are also concerned with the understanding and modelling of choices, working largely in parallel and with little communication with traditional choice modellers. This work looks primarily at a deeper study of choices at the individual level and the treatment of rationality, and has gained added prominence in recent years with the publication of widely read books, for example by Daniel Kahneman and by Dan Ariely. To recognise this, and promote better collaboration between fields, the present volume contains two selected contributions from scholars in these disciplines as well as a number of chapters written by traditional choice modellers working at the interface with the behavioural fields.

The question of course arises: ‘Why a handbook, and why now?’ There are several excellent textbooks on choice modelling, in addition to choice modelling being a key technique in chapters in discipline-specific handbooks, notably in transport and resource economics. The success of the recently established International Choice Modelling Conference series highlights the cross-disciplinary nature of the topic, as well as the desire (and need) for cross-fertilisation. It is in this spirit that the present volume aims to provide a collection of authoritative chapters on what we feel are key research areas, invited from leading colleagues from the field and thoroughly peer-reviewed. The book aims to provide an overview of key topics, highlighting the major ongoing developments, as well as to indicate directions for future research. It is our hope that it will lead to improved communication and cross-fertilisation across fields, as well as stimulating better uptake of advanced methods in practice.

The book is divided into a number of parts, grouping together contributions that fall into the same general area.

Part I following this introduction comprises three chapters looking at foundational issues. Nobel Prize winner Daniel McFadden, the leading architect of developments in choice modelling in the past 50 years, opens the book by discussing a move away from classical consumer choice theory and recognising the developments for example in psychology. This leads us directly to contributions by leading authors from mathematical psychology and behavioural economics. Busemeyer and Rieskamp highlight the need for an understanding and modelling of the dynamic nature of choice processes to arrive at reliable insights on beliefs and values. Loomes and Blackburn focus on an issue at the heart of research across different fields, namely, the modelling of choice under risk and uncertainty, and put forward a framework for a richer treatment of the key factors at play.

The understanding and modelling of choices is entirely dependent on good observations, and this is the topic of Part II. Goulias and Pendyala discuss the importance of context in decision-making and look at how this can be adequately accommodated in data elicitation processes. While a majority of studies, across fields, now rely on stated
preference data, revealed preference data still has much to offer, and Rieser-Schüssler and Axhausen discuss this in the specific context of transport studies where there is growing uptake of automatic data collection methods. This contribution is followed by three chapters looking at specific issues in a hypothetical choice context. Rose and Bliemer provide an extensive overview of experimental design for stated choice surveys, drawing on evidence from different fields and putting the developments into context. While stated preference surveys relied for many years on simple discrete choice data, a growing number of studies are aiming at a fuller elicitation of preference structures and Flynn and Marley look at the recently popular approach of best–worst scaling. Carson and Czajkowski next look at the use of experimental data in the vibrant area of environmental economics where revealed preference data is often not an option, given the hypothetical nature of the valuations of interest. The use of data on hypothetical choice has always led to some degree of criticism in relation to differences from behaviour in real choices, and Harrison closes this section of the book through a discussion of this potential bias and how it might vary across settings and approaches.

The interest in understanding and modelling variation in preferences across individual decision-makers is nearly as old as choice modelling itself. Part III looks at different approaches for modelling different types of heterogeneity. Fosgerau starts by discussing the use of nonparametric distributions in random coefficients models, and specifically looks at simple ways of capturing the unknown shapes. Hensher looks at attribute processing as a key source for heterogeneity across individual decision-makers, presents an overview of modelling approaches in that area and makes the link with the wider literature on heuristics. Chorus is specifically concerned with the assumptions on decision rules in models and the potential advantages but also pitfalls associated with using alternative decision paradigms in our analyses. Finally, Hess looks back at the use of latent class approaches as a tool for capturing heterogeneity, and places this in the context of recent work on the topics of attribute processing and decision rules covered in the preceding two chapters.

While a large majority of research continues to focus on simple discrete choice, there are departures from this in multiple directions. In the first chapter of Part IV (Chapter 15), Greene presents a thorough introduction to models for choosing among ordered alternatives. A different departure from simple discrete choice comes in the form of decisions made jointly by multiple individuals, and an in-depth discussion of appropriate models for such choices is given by de Palma, Picard and Inoa in Chapter 16. One of the most active areas of research in choice modelling in the last few years has been concerned with the development of hybrid choice models, most notably with a view to accommodating a range of soft factors such as plans, attitudes and perceptions in decision-making; Abou-Zeid and Ben-Akiva provide an overview of the advantages of such models over structures explaining choices alone. Harrison and Martínez-Correa next return to the issue of decision-making under risk and uncertainty and, specifically, how individuals manage these risks when making choices. Finally, Bhat and Pinjari look at the important link between discrete choices and continuous consumption, providing an overview of existing work on multiple discrete–continuous choices and setting a research agenda for the field.

The development of more powerful computers and estimation techniques has opened up the possibility of working with ever more complex model structures, but this in turn
poses new issues in terms of model specification and inference. Additionally, model complexity is at the very least keeping up with the developments in computational power, and model estimation of the most advanced structures remains a substantial challenge. In many areas, Bayesian techniques have been put forward as an alternative to classical approaches, and in the first chapter in Part V (Chapter 20), Lenk gives a historical overview as well as providing the readers with a range of techniques to use in practice. While sample-level estimation remains the standard approach for the majority of choice modelling applications, the ability to estimate models at the level of individual decision makers has major appeal, and Frischknecht, Eckert, Louviere and Ribeiro discuss simple ways of doing so, drawing also on developments on best-worst scaling, linking to the Flynn and Marley’s Chapter 8 in this volume. The growing popularity of hybrid choice models, as discussed earlier in Chapter 17 by Abou-Zeid and Ben-Akiva, has posed new issues notably in terms of identification and this is discussed in detail by Vij and Walker in the next chapter. In the final chapter in this part, Bunch gives a very thorough grounding in alternative estimation and inference techniques, with a strong focus on the inner workings of the approaches.

While model specification and estimation receive the majority of attention, especially in the academic literature, the real-world emphasis is on the analysis and use of results. Two different uses are covered in the penultimate part of the book, with Karlström focusing on use of model results in appraisal while Daly looks at using the models themselves in forecasting future choices.

Up to this point, the chapters have focused on individual topics of research, the majority of which cross the boundaries of different disciplines. The final part of the book recognises that the specific needs in terms of methodology and behavioural insights vary substantially across fields. To this extent, we include four chapters covering what we believe to be the most active disciplines in choice modelling, each time setting an agenda for future research. Swait and Feinberg cover marketing, Adamowicz, Glenk and Meyerhoff focus on environmental and resource economics, Lancsar and Burge do the same for health economics and, leaving our own discipline until the end, Ortúzar, Cherchi and Rizzi look at research needs in transport.

The topics covered in this book are a result of the editors’ perceptions of key topics, also informed by discussions with leading colleagues, where we especially appreciated a substantial input from Moshe Ben-Akiva. A volume such as this can of course never be complete and readers will form their own opinion of where the gaps are – one day, there might be a second edition. Until then, it remains for us to thank all of the authors for producing the chapters that form this handbook, and for taking on board the feedback from a long list of reviewers whose efforts are also greatly appreciated. Without these two groups, a volume such as this would of course not be possible.