ECONOMETRICS INFORMING NATURAL RESOURCES MANAGEMENT:

SELECTED EMPIRICAL ANALYSES

EDITED BY: KOUNDOURI PHOEBE

Publisher: Edward-Elgar Publishing

Series: Wally Oates and Henk Folmer's 'New Horizons in Environmental Economics' Series

Forthcoming, Summer/Fall 2004 (256 pages)

To Nikitas, my inspiration and rock, hopefully throughout this fascinating journey.

CONTENTS.

7. Swanson, T., and A. Kontoleon, 'Conflicts in Wildlife Conservation: Aggregating Total Economic Value'.

8. Stavros Georgiou, Ian Bateman, Matthew Cole and David Hadley, 'Contingent ranking of river water quality improvements'.

9. Groom, B., and A. Kontoleon, 'Comparing expert and individual preferences for the preservation aquatic biodiversity: An experiment'.

PART C: ESTIMATION UNDER UNCERTAINTY

10. Di Falco, S., and C., Perrings. The role of risk properties and farm risk aversion on crop diversity conservation.

11. Koundouri, P., and M. Laukkanen, Stochastic production in fisheries.

12. Christophe Bontemps, Stéphane Couture, Pascal Favard, Is the Irrigation Water Demand Really Convex?

PART D: RESENT ADVANCEMENTS IN ECONOMETRICS METHODS APPLIED TO NATURAL RESOURCE MANAGEMENT

13. Bateman, I.J., and Jones, A.P., 'Contrasting conventional with multi-level modeling approaches to meta-analysis: Expectation consistency in UK woodland recreation values'.

14. Riccardo Scarpa, Kenneth G. Willis and Melinda Acutt, 'Individual-specific welfare measures for public goods: a latent class approach to residential water customers of Yorkshire Water'.

15. Laukkanen, M., ‘Estimation of resource management objectives through empirical likelihood’.

16. Salvatore Di Falco, Using Non Parametric Econometrics on the EKC Hypothesis.

LIST OF CONTRIBUTING AUTHORS.

Melinda Acutt, Revenue and Economic Policy Unit, Yorkshire Water

Arief Anshory Yusuf, Lecturer, Department of Economics and Development Studies, Faculty of Economics, Padjadjaran University, Bandung, Indonesia.
anshory@bdg.centrin.net.id

Ian Bateman, Professor, Centre for Social and Economic Research on the Global Environment (CSERGE) and Zuckerman Institute for Connective Environmental Research (ZICER, School of Environmental Sciences, University of East Anglia, UK. Managing Editor of the Journal of Environmental and Resource Economics.
I.Bateman@uea.ac.uk

Christophe Bontemps, Senior Research Fellow, INRA, Department of Economics, University of Toulouse, France. [INRA, Department of Economics, Chemin de Borde Rouge, B.P. 27- 31 326 Castanet Tolosan, cedex (France). bontemps@toulouse.inra.fr]
bontemps@toulouse.inra.fr

Matthew Cole, Senior Lecturer, Department of Economics, University of Birmingham, UK.
m.a.cole.1@bham.ac.uk

Stephen Couture, Senior Research Fellow, LEF-ENGREF/INRA, Department of Economics, University of Toulouse, France.
couture@nancy-engref.inra.fr

Laurent Dalmas, Research Fellow, CEMAFI, Universite de Nice-Sophia Antipolis, Faculte de Droit, des Sciences Politiques, Economiques at de Gestion, Salle 434 (Batiment Extension), 7 avenue Robert schuman, F-06050 Nice Cedex 1.
laudalm@aol.com

Salvatore Di Falco, Visiting Scholar, Agricultural and Resource Economics Department, University of Maryland, College Park, USA and Research Fellow, Department of Economics, National University of Ireland, Galway, Ireland.
s.difalco@nuigalway.ie

Stavros Georgiou, Senior Research Fellow, Centre for Social and Economics, Research on the Global, Environment (CSERGE), School of Environmental Sciences, University of East Anglia, UK.
s.georgiou@uea.ac.uk

Maria Angeles García-Valiñas, Research Fellow, Department of Economics, University of Oviedo, Spain.
mariangv@uniovi.es.

Hilda Guerrero, G.R., Research Fellow, LEERNA-INRA, Université des Sciences Sociales, Manufacture de Tabacs Bât. F, 21 allée de Brienne, F-31000 Toulouse.
Hilda.guerrero@univ-tlsel.fr

Ben Groom, Research Fellow, Department of Economics and Centre for Socio-Economic Research on the Global environment (CSERGE), Department of Economics, University College London, UK
b.groom@ucl.ac.uk

David Hadley, Research Fellow, Programme on Environmental Decision-Making, Centre for Social and Economic Research on the Global Environment (CSERGE), School of Environmental Sciences, University of East Anglia, UK.
d.hadley@uea.ac.uk
Jones, Andy, Research Fellow, Programme on Environmental Decision-Making Centre for Social and Economic Research on the Global Environment (CSERGE), School of Environmental Sciences, University of East Anglia, UK.
a.p.jones@uea.ac.uk

Phoebe Koundouri, Lecturer in Economics (B), Department of Economics, University of Reading, UK; Senior Research Fellow, Department of Economics/CSERGE, Department of Economics, University College London, UK and Member of World Bank Groundwater Management Advisory Team (GW_MATE), The World Bank, US
p.koundouri@reading.ac.uk

Andreas Kontoleon, Lecturer, Department of Land Economics, University of Cambridge, UK.
a.kontoleon@ucl.ac.uk

Marita Laukkanen, MTT Agrifood Research Finland, Economic Research, Helsinki, Finland.
marita.laukkanen@mtt.fi

Arnaud Reynaud, Senior Research Fellow, LEERNA-INRA, Universite de Touloouse 1, Manufacture des Tabacs – Bat. F, 21 allee de Brienne, F-31000 Toulouse, e-mail: areynaud@toulouse.inra.fr

Alban Thomas, Professor of Environmental Economics and Econometrics, LEERNA-INRA, Université des Sciences Sociales, Manufacture de Tabacs Bât. F, 21 allée de Brienne, F-31000 Toulouse.
thomas@toulouse.inra.fr

Pascal Favard, Professor of Economics, University of La Rochelle, France.
e-mail: pfavard@cict.fr

Charles Perrings, Professor of Environmental Economics and Environmental Management, Department of Environment, University of York, UK. Managing editor of the journal of Environment and Development Economics.
e-mail: cap8@york.ac.uk

Riccardo Scarpa, Lecturer in Environmental and Applied Economics, Environment Department, University of York, UK.
rs24@york.ac.uk

Timothy Swanson, Professor of Economics and Law, Department of Economics, University College London, UK.
tim.swanson@ucl.ac.uk

Ken Willis, Professor of Environmental Economics, School of Architecture, Planning and Landscape (SAPL), Centre for Research in Environmental Appraisal and Management (CREAM), University of Newcastle, UK.
Ken.willis@ncl.ac.uk

ACKNOWLEDGEMENTS

My overwhelming debt is to all the contributing authors of this book, for their devotion to the completion of their chapters in a relative short time period and their participation in the reviewing process of the included chapters. I owe a special intellectual debt to all of them, for providing me with a stimulating and challenging environment, not only throughout the period of editing this book, but also throughout my years in academia. I am also grateful to all my colleagues from the Department of Economics at the University of Reading and the Department of Economics and GSERGE/Economics at University College London, for insightful comments and suggestion that have improved the original draft of the book a great deal. Special thanks, to Ben Groom for referring and proof reading a number of the included chapters.

I am also indebt to two interdisciplinary research teams that I work with. Firstly, every single of the eighty researchers working for the ARID Cluster of European projects that I co-ordinate under the Fifth Framework Program of the European Commission and Research and Environment, DGXII, for funding this clustering initiative. Secondly, my GWMATEs from the Groundwater Management Advisory Team of the World Bank, for widening my understanding to the needs and challenges faced by the developing world. Both of these teams have provided me with feedback from other scientific disciplines, as well as filed experiences, that enriched my way of thinking about the economics of resource management and broaden my understanding of the scientific and policy issues involved.

I also wish to thank my publisher, Edward Elgar Publishing, whose staff was enthusiastic about this project from the beginning. I owe, special thanks to Dymphna Evans, my commissioning editor.

Finally a special debt is owned to my partner, family and friends, who put up with me in such a discreet and endearing manner and … sustain a healthy suspicion to all the writings of economists.

INTRODUCTION

ECONOMETRICS INFORMING NATURAL RESOURCES MANAGEMENT: INTRODUCING THE BOOK

Phoebe Koundouri

Department of Economics, The Reading Business School, University of Reading, UK
Department of Economics and CSERGE/Economics, University College London, UK

The increasing scarcity of natural resources (in terms of quantity and quality) is one of the most pervasive allocation issues facing development planners throughout the world. The need for sustainable management of these valuable resources has become a critical policy concern. Econometrics is a tool that can inform and facilitate such a management. However, it is only recently that natural resource management has attracted the attention and interest of a critical mass of applied econometricians.

This volume outlines the fundamental principles and difficulties that characterize the challenging task of using econometrics to inform natural resource management policies and illustrates them through a number of case-studies from all over the world. The book aims to be a comprehensive sketch of the boarder picture of the state-of-the-art in the area of Econometrics applied to Environmental and Natural Resource Management. The selection of contributions and referee process, opted for a wide range of econometric techniques that can be used to inform natural resource management, while keeping a balance between methods and applications. Applications concern atmospheric carbon reduction, water resource management, wildlife, crop and aquatic biodiversity conservation, fisheries management, as well as broader issues on the relationship between growth, sustainability and the environment. The case studies have been carefully chosen to be of major concern in the arena of environmental policy, mainly in Europe (both EU member states and assessing countries), but also in the US and some developing countries.

The volume begins with a review of the arguments for and the implications of employing Declining Discount Rates (DDRs) in CBA and in the analysis of economic growth and sustainability. Groom and Koundouri show that there exist several growth models in which a relationship has been found between the long-run equilibrium under DDRs and that in which a zero discount rate is employed. This can have the effect of pushing the optimum under DDRs away from the conventional utilitarian outcome towards the Green Golden Rule (GGR) level of capita or environmental stocks. Furthermore, in response to worries that the GGR places weight on the future at too great an expense to the present, Groom and Koundouri highlight the result of Li and Lofgren (2000): DDRs can evoke a solution to resource management problems in which the objective function explicitly takes into account the preferences of present and future generations, such as those posited by. Either zero or conventional discounting does not achieve this solution. It is in these senses that DDRs can be seen to encourage a more equal treatment of generations and promote sustainable outcomes.

Groom and Koundouri, also provide a methodology for the estimation of a working schedule of DDRs assuming that future discount rates and the past provides information about the future. The implications of this are that a correctly specified model of discount rates provides a schedule of DDRs, which values atmospheric carbon reduction 150% higher than conventional exponential discounting, and almost 90% higher than incorrectly specified models. In this sense sustainable outcomes are more likely to emerge from project appraisal with DDRs, but given that the theory of DDRs for CBA reviewed relates to the socially efficient discount rate, such outcomes can also be thought of as efficient.

The rest of the book is divided in four parts. Part A, focuses on the static and dynamic estimations of the demand function of natural resources. The applications concern water resources management and allocation in the industrial and residential sectors. In particular, the first application concerns water pricing reforms in the manufacturing sector of a developing country, Mexico. The second application focuses on residential

demand estimation in an EU-assessing, the Slovak Republic. Finally, the third application concerns estimation of the dynamic demand of urban residential and industrial water in an EU member state.

Given the public good characteristics and externalities inherent in the nature and allocation of most natural resources and environmental services, it is quite often that their demand needs to be retrieved in the absence of an underlying market where these resources are traded. Part B of the book focuses on methods that can be employed for the measurement of willingness to pay (WTP) for flows and stocks of environmental goods and services. In particular, this part of the book introduces policy-oriented applications of valuation methods, as well applications of advances in the methodology of valuation methods. In brief, these are the hedonic pricing technique, the contingent valuation method, the contingent ranking technique, and Delphi experiments (consultation/consensus of experts).

Parts A and B of the book have addressed problems in which agents are assumed to function under certainty. However, stochasticity and resulting risk, are inherent in most problems of natural resource and environmental management. Part C of the book focuses on the challenges that face econometricians when faced with the difficult task of assessing demand and supply attributes of stocks and flows of natural resources when these are used as input in stochastic production process. Applications concern the role of risk and risk preferences in crop diversity conservation and fisheries management, as well as characterization of irrigation water demand under uncertainty.

Finally, Part D of the book introduces recent advances in the use of econometrics applied to natural resource management. These include advances relevant to the valuation literature, as well as to the more general environmental management literature. In particular, this final part of the book includes a chapter that presents a variety of meta-analysis models, contrasting conventionally estimated models with those provided by novel, multi-level modelling techniques, as well as a chapter on the evaluation of new estimation techniques for valuing taste heterogeneity. A third chapter introduces a new

econometric methodology for examining whether regulations imposed by a management authority comply with the economic objective of discounted rent maximization. Finally, the last chapter of the book uses non-parametric econometric techniques to evaluate the relationship between economic development and environmental quality, the so-called Environmental Kuznets Curve.

PART A: STATIC AND DYNAMIC DEMAND ESTIMATION.

The chapter by Guerrero and Thomas deals with the effects of water pricing on the manufacturing sector in Mexico. In particular, they investigate the responsiveness of water demand in the Mexican manufacturing section and hence the efficiency of pricing as an economic tool for water demand management. Estimation is performed on a translog cost function, using a sample of 500 Mexican firms distributed in eight industries (mining, food, sugar beverage, textile, paper, chemical, and steel) for the year 1994. Empirical results demonstrate that industrial water demand is not very sensitive to water price, and that water is a substitute for both labor and materials in the sense of the 'Morishima Elasticity of Substitution' (see Blackorby and Russell, 1989). Finally, another important finding of the application with regards to water resource management, is that conditional on water availability zone, water average productivity is highly and positively correlated with water price.

Moving from demand estimation applied to a cross section to one applied on a panel data-set, the chapter by Dalmas and Reynaud, focuses on the estimation of residential water demand in the Slovak Republic, using a sample of 71 municipalities observed from 1999 to 2001. Three different functional forms for demand curve are estimated and compared: a lin-lin specification, a log-log form and a Stone-Geary function. Results indicate an inelastic but price responsive water demand, with slightly higher elasticity than that of EU member states. These results suggest the potential importance of price as a policy tool to manage water scarcity.

The chapter by Maria Angeles García-Valiñas, makes the move from static to dynamic demand estimation. In particular, it focuses on the characterization of water demand in an urban context by estimating water demand for domestic and commercial/industrial levels in a Spanish municipality. Estimation of two dynamic demand models is performed on a microeconomic intra-annual panel of households and firms, using Blundell and Bond's (1998) econometric methodology. That is, estimation of the dynamic error components model is considered using two alternative linear estimators that are designed to improve the properties of the standard first-differenced GMM estimator. Both estimators require restrictions on the initial conditions process. Results on the different degrees of responses of the two specified groups of users, inform the design of optimal tariffs for the service.

PART B: PREFERENCE VALUATION METHODS.

The first chapter of the second part of the book is set out to derive willingness to pay for different water sources in Indonesia, in an attempt to access the potential of the Demand Driven Approach (DDA) to water provision. The DDA has been one important aspect of the new paradigm in water provision as opposed to the "old" paradigm of the Supply-Driven Approach (SDA). The proponents of the DDA approach argue that water is an economic not a social good and its efficient provision has to be directed to those who are willing to pay for it. Many case studies using the Contingent Valuation Method (CVM) suggest that people in poor rural areas of the developing world are willing to pay a significant portion of their income for water and reject the so-called 3-5% rule (which translates into water charges should not exceed 3-5% of consumers income). Using hedonic analysis on a nation-wide microeconomic data-set from Indonesia, Anshory and Koundouri, provide evidence that in urban areas, people do value the services derived from existing improved domestic water sources (piped and pump water). However, the same is not true in rural areas. Moreover, they find that people in both urban and rural areas do not seem to reveal any valuation of communal water sources, probably due to free-rider problems deriving from the public good nature of these water sources. In general, the results by Anshory and Koundouri imply that people in rural Indonesia are

not willing to pay for improved domestic water sources, which might indicate that existing services are of very low quality in rural areas or severe income constraints in these areas. In either case, the results constitute a challenge to the DDA approach. If the first argument is correct, then the DDA approach can be implemented only if the supply-side provision is of acceptable quality. If the second argument is correct, then the demand-side approach is not easily implementable and subsidization of water provision is still called for.

Moving from the case where valuation can be inferred from transactions in a related market, Swanson and Kontoleon contemplate biodiversity valuation when no market behaviour exists, on which valuation can be based on. Total economic values for endangered species have been stated to be the sum of the range of potential use and non-use values corresponding to a given species; however, it is clear that these values do not aggregate in such a straightforward fashion. This is so since the utilisation of wildlife from one constituent affects the production or utility functions of another leading in essence to various forms of production and consumption externalities between these parties. These types of conflicts between values are at the heart of most disagreements over the direction of conservation witnessed in international wildlife institutions such as CITES. The paper by Swanson and Kontoleon examines the extent and nature of these conflicts within the context of a case study on the Namibian Black Rhinoceros. The study consist of a contingent valuation survey that ascertained the willingness of the UK public to pay to support various forms of conservation programmes for the Black Rhinoceros, ranging from the least intensive (eco-tourism) to the most intensive and intrusive (trophy hunting). The authors find that the strongest conflict between UK-based conservationists is not between animal welfare supporters and animal users (both of which support broad-based conservation measures); rather, they find that the greatest conflict exists between those who receive utility from the use of animals and those who receive disutility from others' use of animals. That is, there is a substantial vicarious disutility motive (akin to a consumption externality) imbedded within the aggregate willingness to pay for non-use of this species. This discussion demonstrates that the fundamental nature of the conflict within a forum such as CITES is not between animal

welfare lobbies and general conservationists; rather, the fundamental conflict is between those who enjoy specific uses of a species and those who receive vicarious disutility from this activity by others. This implies that some countries may be able to maximise the total economic value of a particular species by the proscription of specific uses provided that mechanisms are instituted to tap the willingness to pay for such proscriptions

The chapter by Georgiou, Bateman, Cole and Hadley, also focuses on valuation of natural resources through survey methods and follows naturally Swanson and Kontoleon's work. In particular, the method used is contingent ranking (Smith and Desvousges, 1986), which is a survey-based technique designed to isolate the value of individual product characteristics (attributes), which are typically supplied in combination with one another. In this chapter, Georgiou, Bateman, Cole and Hadley provide us with the first study in the UK to estimate the benefits of river water quality improvements in terms of the objective water quality indices. In particular, the authors assess the benefits of water quality improvements in the River Tames with regards to recreational and biodiversity improvements. The results of the study come at a timely moment for consideration by the authorities responsible for water management in the UK. Recent interest in the use of stated preference methods has been expressed by bodies such as the Environment Agency, who are in the process of developing guidelines for the assessment of river water quality improvements. This study hopes to provide useful input into the debate over the use of monetary valuation techniques in this context and should serve to show some of the relative merits and limitations associated with the techniques discussed.

The NOAA guidelines for the implementation of stated preference techniques for economic valuation of environmental resources (Arrow et al 1993) suggest that the outcomes of stated preference techniques should be compared to the opinions and rankings of experts as a test of their validity. Theoretical and empirical studies have indicated that the reliability of stated preference responses may be called into question when the level of information or knowledgeability that respondents bring to the survey is low, where there is a low level of familiarity with the good being valued, or the 'relevance' of the good to the individual is in question (Ajzen 1996, Bergstrom et al

1989). In such cases the value of expert opinion as a validation of stated preference techniques might be amplified. Despite this only a few studies have addressed the reasoning behind the use of expert opinion in this way or have compared the preferences of experts and members of the public over the same goods (Boyle et al., 1995, Kenyon and Edwards-Jones, 1998). To our knowledge no comparison has been made between the preference orderings of experts and members of the public for goods with a large non-use value component, the very class of resource values where the aforementioned problems are most likely to arise. Groom and Kontoleon address the NOAA recommendation through the comparison of the outcomes of a Delphi experiment (consultation/consensus of experts) and a CVM survey, both of which address decisions concerning the same environmental resource. The comparison is broadened by the use of different levels of information for subsets of respondents to assess the informational effects, and hence different levels of knowledgeability on willingness to pay bids. This is undertaken for an environmental good for which non-use values is the predominant class of economic values, and for which public familiarity is low, i.e. Remote Mountain Lakes.

PART C: ESTIMATION UNDER UNCERTAINTY.

The chapter by Di Falco and Perrings assesses the potential role of risk properties in crop diversity conservation. It has been found that the impact of biodiversity on the variance of farm profits along with farmers risk aversion has a pivotal role in determining agro-biodiversity. The authors show that if diversity is negatively related to production variance, the agro-ecosystem will have more diversity. The adoption of a Just and Pope specification provides a straightforward way of modelling farmers crop diversity choices when uncertainty takes place, and to estimate the role of agro-biodiversity on the mean and the variance of farm income. An application example, based on data on the South of Italy, is presented. This geographical area has been classified as a *Vavilon megadiversity* area for cereals. It has been found that diversity is negatively related to the variance of production. Hence, at least in the long-run, keeping crop diversity is a risk reducing activity.

As indicated in the previous paragraph, Di Falco and Perrings use Just and Pope's (1978) methodology for estimating stochastic production function. Just and Pope have identified the restrictiveness of the traditional approach (theoretical and empirical) to evaluating the impact of the choice of inputs on production risk, which amounted to making implicit, if not explicit assumptions to the effect that inputs increase production risk. For this reason thy have proposed a more general stochastic specification of the production function which includes two general functions: one which specifies the effects of inputs on the mean of output and another on its variance, thus allowing inputs to be either risk-increasing or risk-decreasing. The methodology is applied to crop diversity conservation.

While Just and Pope's model is a generalization of the traditional model, as it does not restrict the effects of inputs on the variance to be related to the mean, Antle (1983, 1987) has shown that it does restrict the effects of inputs across the second and higher moments in exactly the way traditional econometric models do across all moments. Thus Antle's departure point was to establish a set of general conditions under which standard econometric techniques can be used to identify and estimate risk attitude parameters as part of a structural econometric model, under less restrictive conditions. More specifically, Antle's moment-based approach begins with a general parameterisation of the moments of the probability distribution of output, which allows more flexible representations of output distributions and allows the identification of risk parameters.

Koundouri and Laukkanen, in the second chapter of Pat C of the book, employ Antle's specification to estimate the stochastic production technology and risk preferences of fishermen in the North Sea Fishery. Their results show that, fishermen are risk averse and that failure to include risk aversion behavior in the characterization of the production function might bias parameter estimates and give wrong results with regards to technological parameters. Risk aversion behavior is translated in terms of risk premium, which is viewed as the implicit cost of private risk bearing. Risk premium as a percentage of mean profit is found to be different between mobile and static gears, with mobile gears exhibit higher premia by 10% and 8% of profit, for capital and days at the sea inputs,

respectively. The authors conclude that neglecting risk considerations when assessing impacts of regulation policies on input choices and expected profit could provide misleading guidance to policy makers. This is a significant piece of warning to all policy makers contemplate regulation of stochastic production process in general, and fisheries in particular.

The third chapter of Part C of the book proposes an approach for modelling irrigation demand under uncertainty. Despite the rising concern over the economic regulation of irrigation water demand, no general modelling approach of this demand under uncertainty has been developed. Bontemps, Couture and Favard develop a framework in which such modelling can be carried out and demonstrate the characterization of the demand function for irrigation water. In particular, they use the programming model framework to derive an inverse water demand under uncertainty. The resolution procedure of the model is numerical and is composed of the agronomic model, EPIC-Phase, the economic model, and an algorithm of search of the solution. In their application, they find the presence of inflexion points in the irrigation water demand curve and analyse the effects of this result in terms of policy analysis.

RESENT ADVANCEMENTS IN ECONOMETRICS METHODS APPLIED TO NATURAL RESOURCE MANAGEMENT

Part D of the book is introduced by Bateman and Jones, who present a variety of meta-analysis[1] models of woodland recreation benefit estimates, contrasting conventionally estimated models (i.e., expressed preference methods such as contingent valuation (CV) and conjoint analysis (CA), together with revealed preference techniques such as hedonic pricing (HP) and individual and zonal travel cost (TC)) with those provided by novel, multi-level modelling (MLM) techniques. The authors find that while both sets of results

[1] Meta-analysis is the statistical analysis of the summary of findings of prior empirical studies for the purpose of their integration. This kind of analysis offers a transparent structure with which to understand underlying patterns of assumptions, relations and causalities, so permitting the derivation of useful generalizations.

generally conform well to expectations derived from their theoretical considerations or empirical regularities, conventional regression findings suggest that certain authors and forests are associated with larger recreation value residuals. However, the more sophisticated and conservative MLM approach shows that these residuals are not large enough to be differentiated from variation that might be expected by chance. Moeover, allowing, for the fact that the MLM approach explicitly incorporates the hierarchical nature of meta-analysis data with estimates nested within study sites and authors, leads to the conclusion that these residuals are not a significant determinant upon values. This suggests that, at least in this aspect, estimates may be more robust than indicated by less sophisticated models.

The next chapter is also relevant to recent advances in the valuation literature. In particular, Scarpa, Willis and Acutt use multi-attribute stated preference data derived through choice experiments to investigate the presence of a finite number of preference groups in a sample of Yorkshire Water residential customers. The chapter explores alternatives ways of modelling heterogeneity of tastes for attributes of a composite public good via choice experiments. The authors focus on public good values and retrieve the implicit customer specific welfare measures conditional on a sequence of four observed choices. They assess and contrast the sample evidence for the presence of 2, 3 and 4 latent classes of separate preference profiles, and show the non-parametric kernel densities of the implicit marginal values for river quality, area flooding, presence of odour and flies, water related amenities and other externalities produced by water and waste treatment companies. With regards to the econometric methodology used in the analysis, they depart from the conventional way of analysing multinomial discrete choice responses via multinomial logit models and mixed logit models. The analysis employs an alternative characterization of preference heterogeneity via finite mixing (Provencher, et al. 2002) or latent class analysis (Boxall and Adamovicz, 2002). Their approach, perhaps less elegant and flexible than the continuous mixing allowed by mixit logit (Train, 2003), is shown to have some appeal on the basis of ease of interpretation of the utility functions of each preference group identified in the sample, as well as ease of computation. The main feature of the method used is that instead of a continuum of taste intensities for each

attribute of choice, it provides the preference structure for each of a small number of groups in the sample. Group identification is endogenous, although the number of groups is exogenously imposed, albeit statistically tested for.

The chapter by Marita Laukkanen introduces a new econometric methodology in order to examine how regulations imposed by a fishery management authority comply with the economic objective of discounted rent maximization. The parameters of a dynamic bioeconomic model are estimated using maximum empirical likelihood and time series observations on quota targets, biomass levels and prices of landed fish. The discount rate that is implicit in historical regulatory decisions provides an index of regulatory behavior. The empirical likelihood method of estimation uses the information in the first order conditions that define the solution to a dynamic resource management problem. In addition to parameter estimates the procedure yields optimal weights for the instrumental variables included in the estimation. The results indicate that a fishery manager discounting future at a rate of 15 per cent would set target harvests at about the historical levels, which implies that historical harvest levels have been relatively close to the socially optimal policy.

The last chapter of the book uses non-parametric econometric techniques to evaluate the relationship between economic development and environmental quality in the last ten years. This relationship has captured a lot of attention in the scientific community, while today it is one of the most lively research lines in Environmental Economics. After the seminal paper of Grossman and Krueger (1995), an increasing amount of literature has appeared around the so-called Environmental Kuznets Curve and testing the existence of an inverted U shape between an Environmental quality indicator (e.g. carbon dioxide concentration) and levels of per capita income. Surprisingly, less attention has been paid to the econometrics of the EKC. Recently, Taskin and Zaim (2000) suggested the use on non-parametric estimation techniques to assess the existence of such a parabolic form in the data. The chapter by Di Falco applies possible non-parametric estimators on the EKC hypothesis and compares results between parametric and non-parametric estimators.

References:

Antle, J., 1983. Testing the Stochastic Structure of Production: A Flexible Moment-Based Approach. Journal of Business and Economic Statistics 1, 192-201.

Antle, J., 1987. Econometric Estimation of Producers' Risk Attitudes. American Journal of Agricultural Economics, 509-522.

Arrow, K., R., Solow, P., R., Portney, E. E., Learner, R., and H. Schuman, 1993. Report of the NOAA Panel on Contingent Valuation, Federal Register, 58(10): 4601-4614.

Ajzen I., Brown T. C., Rosenthal L. H., 1996. Information Bias in Contingent Valuation: Effect of Personal Relevance, Quality of Information and Motivational Orientation, Journal of Environmental Economics and Management, 30, 43-57

Bergstrom J. C., Stoll J. R., Randall A., 1989. Information Effects in Contingent Markets, American Journal of Agricultural Economics, 71(3), 685-691.

Blackorby, C. and Russell, R. R., 1989. Will the Real Elasticity of Substitution Please Stand Up? (A Comparison of the Allen/Uzawa and Morishima Elasticities. American Economic Review, 79(4), 882-888.

Blundell, R. and Bond, S. (1998). Initial Conditions and Moment Restrictions in Dynamic Panel Data Models', Journal of Econometrics, 87, 115-43.

Boyle K. J., Welsh M. P., Bishop R. C., Baumgartner R. M., 1995. Validating Contingent Valuation with surveys of Experts, Agricultural and Resource Economics Review, October, 247-54.

Boxall, P. C., and V., L., Adamovicz, 2002. Understanding heterogeneous Preferences in Random Utility Models: The Use of Latent Class Analysis. Environmental and Resources Economics, 23(4): 421-446.

Kenyion W., Edward-Jones G., 1998. What Level of Information Enables the Public to Act like Experts when Evaluating Ecological Goods? Journal of Environmental Planning and Management, 41(4), 463-75.

Li, C. Z., and K.G., Lofgren, 2000. Renewable Resources and Economic Sustainability: A Dynamic Analysis with Heterogeneous Time Preferences. Journal of Environmental Economics and Management, 40, 236-250.

Just, R. & R. Pope, 1978. Stochastic Representation of Production Functions and Econometric Implications. Journal of Econometrics 7, 67-86.

Grossman, G., M., and A., B., Krueger (1995), Economic growth and the Environment. Quarterly Journal of Economics, 110(2).

Provencher, B., Barenklau, K.A., and R.C., Bishop, 2002. A finite mixture logit model of recreational angling with serially correlated ransom utility. American Journal of Agricultural Economics, 84: 1066-1076.

Taskin, F., and O., Zaim, 2000, Searching for a Kuznets curve in environmental efficiency using kernel estimation. Economic Letters, 68, 217-223.

Train, K., 2003. Discrete Choice Methods with Simulation. Cambridge University Press.

Smith, V. K., and W. H., Desvousges, 1986. The Value of Avoiding a LULU: Hazardous Waste Disposal Sites. Review of Economics and Statistics, 68: 93-99.