



Handbook of Computational Econometrics

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Handbook of Computational Econometrics

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This book will appeal to econometricians, financial statisticians, econometric researchers and students of econometrics at both graduate and advanced undergraduate levels"—Provided by publisher.

Summary: "This project's main focus is to provide a handbook on all areas of computing that have a major impact, either directly or indirectly, on econometric techniques and modelling. The book sets out to introduce each topic along with a more in-depth look at methodologies used in computational econometrics, to include use of econometric software and evaluation, bootstrap testing, algorithms for control and optimization and looks at recent computational advances"—Provided by publisher.

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Handbook of Computational Econometrics

To our families

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Preface

This volume comprises eleven chapters dealing with a variety of aspects of computational econometrics. Computational econometrics is a discipline that, to those who do it, is easily understood, but, to the wider field, appears to be difficult to define. Many (most) top-level econometrics journals ignore the subject altogether, and most econometrics textbooks give it short shrift, providing, at best, practically useless treatments. Yet its substance is the very heart and soul of applied econometric practice, the essential means by which most econometric studies take place. The result, as is made clear in several of the chapters in this handbook, is that the computational tools commonly made available to carry out econometric studies can be far from cutting edge, and, worse, quite ill suited for producing the desired results. A major goal of this handbook, then, is to examine the state of the art of computational econometrics and to provide exemplary studies dealing with computational issues arising in a wide spectrum of econometric fields.

Econometrics has, by its very nature, a large statistical component. But econometricians differ from statisticians in at least one important aspect: statisticians are essentially mathematicians dealing with probabilistic phenomena not necessarily related to any specific discipline, whereas econometricians are trained in both statistics *and* the discipline of economics. They bring to the table, therefore, a particular point of view that shapes the kinds of studies they find of interest and the kinds of tools they find appropriate to use and to develop. This has resulted in a discipline with a flavour of its own, a flavour that is inherited by those engaged in the computational aspects of econometrics.

Computational econometrics has several main subfields, all represented in this handbook. These include: the development of computational techniques for carrying out econometrics, such as estimation or numerical methods; studies in which the computer is the central playing field, such as Monte Carlo experiments, genetic algorithms, network studies, or estimation methods like simulated annealing; studies in which the computer does the necessary heavy lifting, such as nonlinear estimation of large-scale systems or massive simulations; and the development of computational environments in which to conduct econometric studies, such as GAMS or Stata. All such potentially diverse studies fall into the rubric of computational econometrics, and that is perhaps the reason the field is so difficult to define. This handbook contains studies in all these categories. All attempt

to provide a self-contained overview of their subject and, where relevant, an accessible technical development along with examples or illustrations. They should be of value to those learning as well as to those well versed in the field.

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Econometric software

Charles G. Renfro

1.1 Introduction

The production and use of econometric software began at the University of Cambridge in the early 1950s as a consequence of the availability there of the first operative stored-program electronic computer, the EDSAC (Electronic Delay Storage Automatic Calculator). This machine became available for academic research starting in or about 1951 [214, 248, 249]. Among the first to use it were members of the Department of Applied Economics (DAE), some of whom had been invited to Cambridge by the Director, Richard Stone. From the beginning, they employed the EDSAC to produce work that remains well regarded [8, 77, 124, 195]. They also appear to have been the first to describe in print the workaday process of using a stored-program computer [36]. There, Lucy Slater, working with Michael Farrell, wrote the first distinguishable econometric software package, a regression program [14, 224, 225]. However, these economists were not alone in their early adoption of emerging computing technologies, for previously, in 1947, at one of the first gatherings of computer designers, the Symposium on Large-Scale Digital Calculating Machinery, Wassily Leontief [153] had presented some of his then current work on inter-industry relationships to provide an example of a challenging computational problem. He used the existing electromechanical 'Mark I' Automatic Sequence Control Calculator at Harvard, which, although not actually a stored-program electronic computer, can nonetheless be described as the first 'automatic digital computer' [248]. The Mark I also represents IBM's start in a business it was later to dominate.

At the time, worldwide, these machines were the only automatic computing devices generally available for research. Consequently, other computationally inclined