

Preface

Finance is about managing money. It is about making provisions and allocations of funds for a business project with an assessment of risks and benefits. There are several instruments for dealing with money. There are several places for trading these financial instruments. There are mathematical models for optimal selection of financial portfolios and for predicting their assets' future values. And there are computers to help us with all the necessary real-world data crunching to exploit the formal models to unprecedented possibilities.

Computational Finance includes all numerical methods, theories of algorithms and optimization heuristics geared to the solution of problems in economics and finance. The subject area is broad and requires knowledge in computational statistics, econometrics, mathematical finance and computer science, of course.

This book is the product of a seminar course taught every year since 2010 at the Computer Science Department of the Technical University of Catalonia (Universitat Politècnica de Catalunya), in which I have attempted to cover some of the material from every diverse area of knowledge required for the computational resolution of financial problems. To accomplish this task, I had to avoid lecturing in-depth on any one topic, and touch upon the surface of every topic I considered necessary for Computational Finance. This style of learning is reflected in the book, where the emphasis is on methods and not much on theorems and proofs, although I try to be as rigorous as possible and, in the absence of a proof, I give pointers to the literature from where to learn it. It is this aspect that makes the contents of this book an introductory course, with special attention to the software implementation of econometric models and computational exploration of financial instruments. All programming examples in this book are implemented in the free programming language R, with all the codes exhibited and commented in the text; there is also the possibility to download all programs from the book's website.¹ The Appendix contains a brief introduction to R, for those not acquainted with this software language.

For whom is this book intended? The truth is that one writes the books that one would like to read. I am a mathematician, working in a Computer Science Department and an amateur investor in stock markets. Therefore, this book was

¹ <http://computationalfinance.lsi.upc.edu>.

written for advanced undergraduate or graduate students in computer science, mathematics, business and non-academic financial investors, at least to some extent. For the business and non-academic class of readers, I suggest the following reading plan: [Chapters 1, 6 and 8](#); at any point beyond [Chap. 1](#) look back into [Chap. 2](#) for the basic concepts in statistics, and afterwards jump to any chapter that attracts your attention. Computer science students should follow the plan of the book in order; after all the book was conceived from a seminar course in a Computer Science Department, intended mainly for computer science students. Mathematicians can follow either of the previously suggested reading paths.

I am indebted to several people who provided comments or corrections. I am grateful to the students in the different editions of the seminar in Computational Finance, first for their willingness to participate in this seminar, and for their inputs on the lessons that originated most of the chapters in this book. My greatest gratitude is for Alejandra Cabaña and Enrique Cabaña, who made profound corrections to a first draft of the chapters on statistics and time series analysis, obliging me to rewrite them in a decent and correct manner. Alejandra went further on reading succeeding versions and provided me with further corrections. Many thanks go also to my friend Jesus Carrero, who gave me helpful insights from the perspective of a mathematician in the finance industry; following his suggestions, I extended the presentation on Monte Carlo methods more than I had originally intended. Thanks to Joaquim Gabarró who kindly proofread final versions of some chapters, providing many comments that helped me improve their readability, and to my editor Keith Jones and the supporting team of Atlantis Press for their patience and cooperation throughout the stages of production of the book. Finally, I am grateful to all the members of my family and friends for their continuous support during the process of writing this book. To them I dedicate this work.

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