

Decision Making Under Uncertainty:

A Statistical Approach

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Using
Simulations to
Improve
Decision-
Making

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Prologue

I have the immense pleasure and responsibility to introduce this book by an author who was a fellow Physics student of mine with whom I share the experience of having reoriented our professional life toward fields of knowledge that diverge from our original doctorate studies.

Dr. Muro's professional reconversion has demanded to reconcile his teaching work with a permanent dedication to learning and research. His years' long dialectical is a guarantee of the excellence of this book I present here.

This is not a book written for experts, but for those who, like me, having a solid background in any scientific or technical field of study, are in need of strengthening their professional activity by incorporating new methodologies that further strengthen the decisions we must make on a daily basis.

For this reason, I consider it pertinent to share my opinion about this book, which I consider of great versatility and usefulness. These qualities are based on an exquisite work that includes theoretical development, real case studies, and multiple examples of applicability.

The variety of topics presented and their extension is a testament to the dedication and exhaustive research carried out by the author. I would also want to emphasize the remarkable simplicity with which he explains concepts and situations taken from a wide range of economic and business activities, which no doubt resemble many of the ones readers face every day. Having done this without sacrificing comprehensiveness or mathematical rigor, I consider this book to a solid tool to begin studying statistics applied to decision-making. For those who are new to the topic, this work will enable them to deepen their knowledge in different areas of this broad discipline, leveraging the novel approach and narrative prowess of the author.

I trust that this enjoyable book is set to become a classic in university and business libraries, and for everyone whose work is related to decision making. Also, its content on statistical concepts applied to economics will make it an excellent study book for university students for higher learning centers.

I'd like to take this occasion to share my satisfaction for reading this book with teachers, students, professionals, speakers, and readers in general and to congratulate the author for his excellent work.

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Preface

This book is dedicated to understanding the concepts of decision-making and how to apply statistical methods for problem-solving and data analysis. From the initial chapters, we will discuss ways in which these concepts and techniques can serve as useful tools for decision-making.

Every chapter will present questions, exercises, and cases to illustrate each new concept, to learn the application of statistics in decision-making. Questions and discussions are intended to practice the concepts introduced, to expand our knowledge and understanding of their applicability to different environments. In this way, exercises will help you practice the use of the Cause-Effect analysis, with all calculations being made using software.

The answers to the exercises and cases are included, as well as the complete computational solutions used to develop each concept. All the expressions necessary to work the problem are provided, and in cases in which there are several problems of the same type, complete or example calculations will be shown.

A *List of Symbols* is provided at the end of the book, including the Greek letters and other symbols frequently uses in statistics -- and in the scientific world in general. We will use these symbols throughout the book for practicality, because they save the need from making longer explanations, and because symbols help identify concepts at first glance and how they relate to other concepts. Also, symbols provide a layer of abstraction that supersedes common language; their meaning is universal and transversal to all languages.

Another thing that will become evident is the need for you to learn to use a software program that will perform the required calculations. Without this ability, it would not be possible for you to handle the amount of data and concepts in this book in a practical

way. Today, this knowledge has become essential, which is why we will learn the concepts and how to apply them.

The software program required needs to enable us to apply statistical knowledge, have the tools to make statistical inferences (which is one of the foundations of decision-making), and it needs to be currently available in the market. After researching and evaluating several software tools, I chose to use Analytica™ because it does not require to use structured programming, although it includes the option, and we will use it marginally in the book. In other words, it uses a language of the highest level that will enable us to focus on the “what it does what to use if for” than on the “how to do it.” Its simple language allows for rapid development without the need for actual programming.

For basic calculations, a spreadsheet or other simple software you already know how to use will be enough. However, to make statistical calculations that involve uncertainty analysis, we will use Analytica™ because, unlike other software, it can create a graphic representation of the problem we are analyzing and the model to build. Together, we will create influence diagrams, which are graphical representations of a problem using nodes and arrows to connect them. These diagrams will not only serve to create a “picture” of the problem but also help communicate it better.

Diagrams are useful to optimize our ability to solve problems because images provide us with an intuitive way of articulating our creative capacity and our natural course of action. Abstraction’s capacity to link a fact with its effect is thus combined with our perception of the world around us. Oftentimes, a demanding or complex environment will require practice to develop our ability to analyze a project using graphical representation to find the best possible solution.

Graphical thinking consists in the ability to schematize, abstract, to express ideas using symbols, and to find the results of significant pieces of information. The use of symbols and graphic processes facilitates the process of information.