

# **Regression Modeling: A Computational Project-Based Approach**

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# Preface

This book was created to:

- provide an applied textbook that integrates content knowledge and computational skills.
- present the statistical methods within a modeling framework
- integrate computational methods into learning research methods

A traditional teaching method involves having student conduct simple statistical algorithms by hand, meaning working out the calculations step-by-step on paper, as to develop an intuition of the methods, and what they are doing. I take a computational approach in an attempt to achieve the same outcome, by encouraging readers to program the algorithms using the computer.

## Model-Based Approach

A major goal of this book is that, after working through it, the researcher has a firm grasp of the general linear model, as a foundation to scientific modeling.

## Computational Approach

I use a programming language, not only to *do* statistics but as a tool to *learn* statistics. simulation is used to develop intuitions about statistical methods.

## Project-Based Approach

Project-based examples,

## **Other Approaches Utilized in this Book**

To the extent possible, I have tried to use empirical studies and other published work when developing projects and research examples. I prioritized articles that provide access to raw data and computer code, as this not only helps readers see how information moves from raw data to peer reviewed publications, but also gives readers “hands-on” experience with the data interpretation process.

I have also utilized research studies of varied quality and challenge readers to evaluate the quality of the studies and give their justification.

I have also scaffolded the various learning objective of the book. For example, I make the transition from the simulated/coceptual example, to the demonstrated empirical example to the empirical project fairly straight-forward early in the book, but less apparent as readers gain skill in this process.

# 1 Introduction to Scientific Modeling

To me, reality consists of all that exists. This includes, physical objects and processes as well as things like ideas, feeling, and beliefs. So, to me, reality is unitary by definition – there is one reality. But it is extremely complicated. I suspect that it is so complicated that we may never be able to fully comprehend it all, as a species, much less any one of us.

Does this mean we can understand reality at all? I don't think so. I don't fully understand how my car works, but I do have basic ideas that allow me to problem solve issues such as when it won't start. When we can't fully understand something, we are left to build an model of that process. I will talk more about models below, but for now think of a model as an oversimplified representation of a much more complex system.

## 1.1 Modeling in Science

### 1.1.1 Modeling Workflow

1. Define a generative model of the sample,
2. Define specific estimand,
3. Define statistical model to produce estimand,
4. Test statistical model (3) using generative model (1),
5. Analyze and summarize sample.

## 2 Simulation in R

## **3 Research Design and Analysis**

## 4 Simple Regression Models



## 5 Multiple Regression Models

## 6 Moderated Regression

## 7 Summary

In summary, this book has no content whatsoever.

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## References

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