

Foreword

This book is unlike any other textbook on financial engineering, primarily because this is not about financial engineering at all. It is about financial hacking.

“A hacker is any person who derives joy from discovering ways to circumvent limitations.”

Robert Bickford

Financial engineering is a far fancier sounding term for what is in practice the same thing, but to those new to the field, it conveys a precision and automation that is simply absent in the real world.

Building appropriate risk tolerances and financial portfolios is not at all the same as building sturdy bridges or efficient transport. There is a lot more art and conceptual work in finance; on the trading floor, the right intuition is far more valuable than the right formula.

This book’s goal is to build your intuition, and in doing so, to show you how you can quickly and easily address complicated issues in risk and finance. Although money has been around for eons, finance itself is a young field. Its future is and will continue to be brighter than its past for many decades yet. A stubborn adherence to past models and assumptions will backfire. The best approach is a fluid and flexible one.

I want to teach you finance through apprenticeship rather than rote memorization. This book is your sandbox. Think of it as the meeting minutes from a weekly research and trading seminar held at a big Wall Street firm or a hedge fund. You can play and make mistakes here so that when it is time to perform for real, you have gotten all the mistakes out of the way, and done it so thoroughly, that you know how to avoid the common pitfalls even in models and derivatives that are brand new.

How Not to Read This Book

Do not read this book in a quiet place while sitting alone and concentrating. Trading floors are busy, bustling places with constant interruptions.

“And now, excuse me while I interrupt myself.”

Murray Walker

Read it on a subway, in a moving vehicle, at a deli, in a bar, on the dance floor, during your Oscar acceptance speech, while you are being knighted, etc.; basically, anytime you can be rudely interrupted. It’s good training.

Occasional quotations like the above punctuate this book. They serve three purposes: first is to interrupt your thinking in case you ignored my advice above and actually found a quiet place to read; second is to give a little break in the action; and third is to sometimes provide an alternative hidden viewpoint.

What You Won’t Find in This Book

If you are looking for a little sleeve with a CD on it, you’ll keep looking for a long time. If you are looking for a web address with all of the code from this book available there for easy download, you won’t be able to find it. It’s not available.

This lack of source code is a feature. How can a lack of something be a feature? And specifically, how can a book about projects not include a CD or a website with the code in it? That seems crazy. But it’s the very point of the book that financial engineers learn by doing, not by copy-and-pasting.

The projects involve and discuss such tools and programming languages as Microsoft Excel, S-PLUS or R, and Mathematica. It is not the purpose of the book to teach any one language, but rather to show how to build projects in various standard tools of the trade and in expressive, easily understandable languages.

Indeed, it is not required or expected that readers know any of these languages or tools at all. The code snippets are intended to be essentially self-explanatory, though occasional tips and tricks do come in.

Examples and code snippets and projects permeate the book, and that means the book can be appreciated in two different ways. Think of it like a book on how to draw cartoons. You could just flip through the book, look at the pretty pictures, and come away with some tips you gleaned here or there. Or you can take the time to do the exercises along the way and truly master the craft.

The code I present in this book is not intended to be used by you directly. In fact, almost none of the code you will ever produce, and hopefully you will produce a lot, will be used, or should be used. Instead, the goal is that when you need to generate similar code, you will be able to do so quickly, without needing to look anything up.

Financial hacking is what traders and their assistants need to be able to do while the counterparty is still on the phone. It is about speed and intuition. You or someone else can later carefully move it to production-worthy code after several layers of quality assurance.

For a similar reason, you also won't find references or an index or a bibliography. It is the 21st century! If you want more information about a particular topic or model or derivative, there are plenty of places to look on the web, places that change and evolve continuously.

Puzzles

Here is something that you *will* find in this book that is so rare anywhere else: puzzles. Deep puzzles that go to the heart of finance.

Want an example?

An investor claims that markets are not normally distributed and indeed have much fatter tails than most people believe. His strategy, therefore, is to buy wings, meaning deep out-of-the-money options that act more like lottery tickets than investment vehicles. (We will of course learn the details about what an option is, and so on, throughout the book.)

He claims that this strategy tends to lose a little bit routinely, because most of the times, the lottery-like wings do not pay off. So maybe he

loses say \$1 million a year during a quiet year. But once in a while crazy things happen and he makes \$20 million.

Do you believe him?

- (a) Sure, sounds reasonable.
- (b) No, he is lying, it is absolutely impossible.

If you answered (a) or (b), then you are wrong.

First, to the cynics who think the investor is lying. It is *not* impossible. Even on liquid equity indices, if you look at monthly returns, large events can happen. If you bet that the market will move by more than ten percent in either direction by the end of the next month, you will usually end up with nothing, but once in a while, when the market moves a lot, you can make a lot of money.

Now, to the believers who think his strategy sounds reasonable. It doesn't, and here's why.

While it is true that over the course of say a month, a large enough move could happen that would generate \$20 million in profit, that move is almost surely the result of a continuous trend. In other words, there exists a day when the profit on the position was only \$10 million, or \$5 million, or even \$2 million, a time when the investor had the opportunity to get out with a profit.

To believe his strategy, you have to think he is a hypocrite. He claims to only hold wings. But once a wing position starts to become profitable, to be consistent, he ought to sell those winning wings, and buy new wings. But if he does that, then he is very unlikely to make \$20 million profits. A lot of that profit comes from the continuing profits of wings that first became profitable and then continued on.

Thus, either the investor is letting past winning wings ride, contrary to his professed strategy, or he is not making as much money as he claims.

Is the above argument correct? It seems plausible. But it's not enough to just argue verbally. By the time you finish this book, you should be able to figure out how to test it through appropriate simulations. I will not tell you or show you how that comes out. I won't even mention this

little puzzle again. It's a little test for yourself to see if you would be able to do it.

That's what building your intuition is all about.

Who You Are

This book is intended for graduate (including both MBA and MS) or motivated undergraduate students in finance, mathematical finance, or financial engineering, and also for new practitioners in the field, or those moving from other areas into quantitative research in financial firms.

There are three ways of teaching and learning finance. MBAs in finance learn case-method and standard finance, mainly by talking. Mathematical finance students learn the elegance and beauty of formulas, mainly by manipulating symbols. But financial engineers need to learn how to build useful tools, and the best way to do that is to actually build them in a test environment, with no real profits at stake.

In the current economic environment, despite slowdowns and job losses by many of the MBAs and mathematical finance people, there has never been a greater need for financial engineers, people who know both the standard finance of the MBAs and the quantitative methods of the mathematical programs, and who can integrate them with an intuition about the market, a focused creativity, and, above all, the ability to get things done.

Why Should You Read This?

This book teaches financial engineering in an innovative way: by providing tools and a point of view to quickly and easily solve real front-office problems. Projects and simulations are not just exercises in this book, but its heart and soul. You as the reader, whether a current or a budding student or practitioner, will not only gain the intuition and expertise to be able to answer general complex questions about risk and finance, you will also learn how to make reasonable inferences based on incomplete information, thus making you extraordinarily valuable to banks, brokerage houses, trading floors, and hedge funds.

Let Me Tell You a Little about Myself

I graduated Harvard University with both a Bachelor's in Computer Science and a Master's in Applied Math in a combined three and a half years. I went to work right away at Long-Term Capital Management, where I traded various equity derivatives strategies in the U.S., Asia, and Europe. Even during the 1998 collapse, my books, and indeed most of the books in the Tokyo office where I was stationed, were profitable. I then joined Ellington Management Group along with my father where we launched and ran their equity derivatives and statistical arbitrage desks, trading convertible bonds, options, and exotic derivatives. We later started and ran our own hedge fund, Maymin Capital Management.

Since closing that fund, I earned my Ph.D. in Finance from the University of Chicago Booth School of Business and am now an Assistant Professor of Finance and Risk Engineering at NYU-Polytechnic Institute. I have about a dozen academic publications and am the founding managing editor of *Algorithmic Finance*, a new journal focusing on the bridge between computer science and finance.

I have also been a policy scholar for a free market think tank, a Justice of the Peace, a Congressional candidate, and a columnist for *American Banker*, the *Fairfield County Weekly*, and *LewRockwell.com*. I am also an award-winning journalist and the author of *Yankee Wake Up*, *Free Your Inner Yankee*, and *Yankee Go Home*. I was a finalist for the 2010 Bastiat Prize for Online Journalism. I also have a J.D. and am an attorney-at-law admitted to practice in California.

My popular writings have been published in dozens of media outlets ranging from *Bloomberg* to *Forbes* to the *New York Post* to *American Banker* to regional newspapers, and my research has been profiled in dozens more, including *The New York Times*, *USA Today*, *Financial Times*, *Boston Globe*, *NPR*, *BBC*, *Guardian* (UK), *CNBC*, *Newsweek Poland*, *Financial Times Deutschland*, and others.

"I am so smart! S-M-R-T... I mean S-M-A-R-T!"

Homer Simpson, "The Simpsons" (1993)

Enough with the introductions. Let's get going!