Recommended Books on Quantitative Finance

Whilst like any author, I recommend my own books, there are certainly many other books which you will need to read in order to master quantitative finance. Here I try to catalogue and discuss the ones that I regard as essential reading. I have tried to stop the list getting too large, since I do not wish to overwhelm the prospective reader. (If you wish me to include your book, send me a copy and I'll consider it. If I get enough free books, I'll start a separate review section.)

I have now created a books forum; the idea is to provide a place for those doing self-study to discuss details in quantitative finance books. So if you are stuck or confused by some detail that's the place to ask.

My books
Encyclopedias
Introductory analysis
Complex analysis
Probability Theory and Stochastic Processes
Basic mathematical finance (except my books...)
Medium mathematical finance
Interest rate modelling
Credit Derivatives
Numerical Techniques
C++
C++ and quant finance
Background

My books

My philosophy on writing books is to write the book that I wish someone had given me when I was learning the subject. My book "The Concepts and Practice of Mathematical Finance" aims to do that for the person I was when I was getting my first quant job and learning mathematical finance. It should probably have been called "The Concepts and Practice of Financial Engineering" as the emphasis is more on applications than dry theory, although the theory is certainly included.

My second book is the book I wanted to read on C++: "C++ design patterns and derivatives pricing." Its objective is to teach the reader C++ design using examples from quantitative finance. The target reader is the wannabe quant who knows how to program procedurally, and knows basic C++ syntax, but doesn't really get all this object-oriented stuff.

With Nick Denson and Andrew Downes, I have written the book "Quant Job Interview Questions and Answers." We gathered questions from many banks over several years from lots of job candidates and distilled them into a book. We include full answers for all questions, and also include possible follow-up questions to help you test your understanding. Purchasers of this book will have a huge competitive edge over those who do not... The second edition was published in 2013.

My third solo book More Mathematical Finance is now out. It goes into much depth than Concepts and focusses on how to think about the numerical implementation of models. If you liked Concepts but want more this is the book to buy.

My fifth book Introduction to Mathematical Portfolio Theory focusses on the mathematics of optimizing portfolio returns rather than on derivatives pricing. It is more accessible than my other books and completely independent of them.

Encylopedias

"the Princeton Companion to Mathematics," editor Timothy Gowers, associate editors June Barrow--Green and Imre Leader. I had the honour to be asked to contribute the article on financial mathematics. This is a surprisingly readable overview of modern mathematics, it does require a certain amount of mathematical sophistication, however. If you are interested in knowing what modern research mathematicians work on this is the ideal book. Anyone seriously interested in mathematics should own a copy.

Buy from amazon.co.uk   Buy from amazon.com

"Encyclopedia of Quantitative Finance" editor Rama Cont. Alan Stacey and I contributed an article on our "intensity gamma" model.

Buy from amazon.co.uk   Buy from amazon.com

Introductory analysis

There is a famous quote: "the reader who finds he does not have the prerequisites for the prerequisites should not lose heart" (or something similar,) basic analysis is the prerequisite for the prequisites. Please note that I recommend 3 books on this topic because I think that it will take less time to read all three than to read the third one alone.

"Yet Another Introduction to Analysis " by Victor Bryant is the book that I wish I had had when I was learning analysis, and if I was to write a book on the topic this is the way I would write it, (except that I won't because Bryant has already done it.) Bryant teaches analysis with lots of motivation and examples. The reader he has in mind knows calculus but cannot see the point of analysis. All mathematics is (or should be!) invented to solve problems and Bryant never forgets this, and explains why as well as how as he introduces each theorem. If you find analysis too dry, this is the book for you.

Buy from amazon.co.uk   Buy from amazon.com

"Mathematical Analysis: A Straightforward Approach" by K.G. Binmore. If you find the jump from Bryant to Rudin too big, then Binmore is a nice in-between choice. This is actually the first book I read on analysis -- Bryant wasn't available at the time.

Buy from amazon.co.uk   Buy from amazon.com

"Principles of Mathematical Analysis" by Walter Rudin. This a great second book on analysis. It starts from first principles but is drier that Bryant. So first read Bryant to get some idea of what is going on, and then work through Rudin to get all the details and to learn enough to prepare you for measure theory.

Buy from amazon.co.uk   Buy from amazon.com

Complex analysis

Complex analysis is not essential to learn probability theory and stochastic processes. However, contour integration and Fourier transforms are indispensable tools for the working quant. It is also one of the most beautiful and useful areas of mathematics.

"Introduction to Complex Analysis" by Hilary Priestley. I learned complex analysis using the first edition of this book. I had never studied complex analysis before and I found the treatment rigorous but pleasurable. I can't think of a better place to start than Priestley. The second edition has more exercises and has divided the book into bite-sized chunks to make it easier for the reader. If you find this book hard then you probably need to spend more time learning basic analysis of the real line so you can follow the mathematical arguments

Buy from amazon.co.uk Buy from amazon.com

Probability Theory and Stochastic Processes

Modern financial mathematics relies heavily on probability theory, if you want to do it well, you really need to learn to think probablistically and to study the theory. To really understand stochastic processes, you need to work through a program of

- basic probability theory
- basis analysis
- discrete-time martingales
- continuous-time martingales
- stochastic integration

I present a sequence of probability books to help you do this.

"Elementary Probability Theory" by Kai Lai Chung. This is the book I first learnt probability theory from. Chung really knows how to write and his target audience is undergraduates doing a first course in probability. The new edition has a section on mathematical finance but I haven't read that bit.

Buy from amazon.co.uk   Buy from amazon.com

"Probability and Random Processes" by Geoffrey Grimmett and David Stirzaker. This is the other book I used when studying probability as an undergraduate. It goes faster and further than Chung but the authors have a real desire to teach as well as present material and is well worth reading.

Buy from amazon.co.uk   Buy from amazon.com

"Probability with Martingales" by David Williams. This book is a joy to read. The author takes a subject often regarded as hard and makes it easy, whilst making it come alive with a chatty informal style. All this without sacrificing rigour. Definitely one of my favourite maths books. This is not a first book on probability theory but is a first book on discrete time martingales.

Buy from amazon.co.uk   Buy from amazon.com

"Brownian Motion Calculus" by Ummo Wiersema. This book is fully rigorous but is a very accessible way to get the basic ideas of Brownian motion and stochastic calculus without getting bogged down in theory.

Buy from amazon.co.uk Buy from amazon.com

"Diffusions, Markov Processes and Martingales: by Chris Rogers and David Williams. This is a two volume set. It is a natural sequel to Williams' "probability with martingales," although the authors quickly repeat much material from that book. This is a very good choice for getting the basics of Brownian motions and continuous time martingales in a rigorous fashion. The second volume then goes on to discuss stochastic calculus. Whilst the second volume is good too, I would recommend reading it after Chung and R.Williams (below.)

Buy from amazon.co.uk   Buy from amazon.com

"Introduction to Stochastic Integration" by K. L. Chung, R.J. Williams. This is the same Chung but a different Williams! I found this to be the most readable account of stochastic integration theory. It assumes knowledge of continuous time martingales, however, so you must learn those elsewhere first.   The authors do all the details, and focus on trying to present the most important case in careful and clear detail rather than trying to work in absurd generality.

Buy from amazon.co.uk   Buy from amazon.com

Basic mathematical finance (Other than my books...)

There is a rather large number of introductory textbooks on financial mathematics each with its own bent. I haven't read most of them inevitably. I mention a few I found helpful.

"Arbitrage Theory in Continuous Time" by Tomas Bjork. This books presents a clear but fairly rigorous exposition of the basics of financial mathematics. It bears some similarities to my book Concepts but is stronger on rigour and lighter on practicalities. Unusually in a rigorous book, Bjork never loses sight of the underlying ideas and does a good job of conveying them. The author's background is as a professor in probability theory, and it shows in his approach and choice of topics; the book is strong on risk-neutral evaluation and expectations, but spends less time on PDEs.

Buy from amazon.co.uk   Buy from amazon.com

"Financial Calculus: An Introduction to Derivative Pricing" by Martin W. Baxter, Andrew J.O. Rennie. This is a light and accessible introduction to the martingale approach to derivatives pricing from a reasonably pure viewpoint. The authors' objective was to teach the reader the basics of the martingale theory without sacrificing too much rigour, and in this they succeeded very well. Be aware, however, that there is not much discussion of practicalities nor of the PDE approach which is barely mentioned.

Buy from amazon.co.uk   Buy from amazon.com

"The Mathematics of Financial Derivatives: A Student Introduction" by Paul Wilmott, Sam Howison and Jeff Dewynne. This is written by experts in applied PDEs for someone with a background in PDEs. It is therefore a good exposition of the PDE approach and well worth reading for getting a grounding in it. If you want to start with the PDE approach and then move on later to the martingale approach it can also be a good book to start with.

Buy from amazon.co.uk   Buy from amazon.com

"Stochastic Calculus for Finance" volumers I and II by Steven Shreve. OK I haven't read these but lots of other people like them, and they do seem to be a pair of the best introductory books available. In particular, they seem to have a good blend of rigour and intuition. Volume I does the binomial tree in great detail establishing all the concepts necessary to do the continuous time case in Volume II.

Buy from amazon.co.uk   Buy from amazon.com

Medium mathematical finance

Once you have mastered the basics, you will need more advanced books both generalist and on specific areas.

"Martingale Methods in Financial Modelling" by Marek Musiela and Marek Rutkowski. This book appears at first to be dry and difficult to read. However, a lot of this is really just the formatting and font chosen by Springer, and the book rewards perseverance, covering many advanced topics in careful detail. As one can guess from the title, the book emphasizes the modern martingale approach to financial engineering, and it is written by two leading researchers on the practical side of the field. Definitely not a first book, however. The book is good on interest rate derivatives in particular.

Buy from amazon.co.uk   Buy from amazon.com

"Financial Modelling with Jump Processes" by Rama Cont and Peter Tankov. Financial markets crash and are inherently jump. There has therefore been much effort devoted in recent years to derivatives pricing using jumpy processes. Cont and Tankov is a nice exposition of this theory covering both jump-diffusion processes and more general Levy processes. The point of view is quite applied with proofs deemphasized.

Buy from amazon.co.uk   Buy from amazon.com

Interest rate modelling

"Interest Rate Modeling" Vols 1, 2 and 3. "Foundations and Vanilla Models, Term Structure Models, Products and Risk Management" 3 volume set by Leif Andersen and Vladimir Piterbarg. Two of the world's leading interest rate quants have teamed up to give a comprehensive state of the art treatment of the pricing and Greeking of exotic interest rate derivatives. This is by far the best treatment of the topic available. It is not introductory so read them once you are comfortable with financial mathematics. They strike a reasonable middle ground between hand-waving and technical obscurities. It inevitably does not cover everything since that would require another three volumes, but it covers a lot.

Buy from amazon.co.uk   Buy from amazon.com

"Interest Rate Models - Theory and Practice: With Smile, Inflation and Credit" by Damiano Brigo, Fabio Mercurio. This is a comprehensive book on the theory and implementation of interest rate models with an emphasis on the LIBOR market model. It has the great virtue that the authors do all the details. Also, don't miss all the great quotes from DC comics.

Buy from amazon.co.uk   Buy from amazon.com

"Engineering BGM" by Alan Brace. The writer is the "B" of BGM. This is the closest thing to a definitive text on the LIBOR market model also known as BGM. It's hard going at points and the writer believes that "less is more" when explaining material. However, it addresses many points not considered elsewhere and is a must for anyone working seriously in the area.

Buy from amazon.co.uk   Buy from amazon.com

Credit derivatives

"Credit Derivatives Pricing Models: Models, Pricing and Implementation" by P.J. Schonbucher. Credit derivatives were a booming area. Schonbucher introduces and discusses many of the standard models with a reasonable level of detail.

Buy from amazon.co.uk   Buy from amazon.com

"Synthetic CDOs: Modelling, Valuation and Risk Management" by Craig Mounfield. This is a gentle introduction to portfolio credit derivatives. If you know nothing of the area and want to get into it this is a good place to start. It's lower level and easier to read than O'Kane. (in Jan 12, amazon.com were selling this at 74% off!)

Buy from amazon.co.uk   Buy from amazon.com

"Modelling single-name and multi-name credit derivatives" by Dominic O'Kane. The author was an executive at Lehmans who left before the meltdown. He has much more coverage of models for pricing portfolio credit derivatives than Schonbucher does and even includes a few pages on the Joshi-Stacey Intensity Gamma model!

Buy from amazon.co.uk   Buy from[amazon.com](amazon.com)

Numerical Techniques

"Monte Carlo Methods in Financial Engineering" by Paul Glasserman. Monte Carlo is the most effective technique for high-dimensional integration. This book is comprehensive and lucid, it's definitely indispensable if you are implementing Monte Carlo pricing models.

Buy from amazon.co.uk   Buy from amazon.com

"Monte Carlo Methods in Finance" by Peter Jackel. Whilst Glasserman's book is the definitive reference for Monte Carlo pricing in finance, Peter's book is the best guide available on the use of low-discrepancy numbers particularly Sobol numbers for high dimensional quasi-Monte-Carlo. Since their use can improve convergence rates from $O(n^{-1/2})$ to $O(n^{-1})$, they are an important tool, and it's essential to get all the details right, Peter's book teaches you how to do this.

Buy from amazon.co.uk   Buy from   amazon.com

"Numerical Mathematics and Computing" by Cheney and Kincaid. This is an undergraduate textbook designed to teach someone with a smattering of numerical analysis how to program models for numerical computation. I found the book very clear and straightforward, and it covers many topics useful to a quant.

Buy from amazon.co.uk   Buy from amazon.com

"Numerical Recipes in C++: The Art of Scientific Computing" by William H. Press, Saul A. Teukolsky, William Vetterling, Brian P. Flannery. This is a compendious collection of C++ source code and discussion of numerical techniques that form an indispensable resource for the working quant. The code suffers a bit from being translated from FORTRAN but is very useful.

Buy from amazon.co.uk   Buy from amazon.com

C++

C++ is a standard tool for implementing pricing models in banks. Some day, something better will supersede it, but for now you have to learn it if you want to get a job as a quantitative analyst. There are also very many books on this topic. The great virtue of C++ books is that they take a lot less time to read than mathematical finance books so you can get through a lot more of them.

First books

There are many first books on C++. I am going to list three and suggest you pick the one that bests suits your background.

"C++ How to Program" by Harvey M. Deitel, Paul J. Deitel. This is an introductory textbook for American undergraduates. This means it goes slow, is comprehensive, uses lots of colour and is easy to read. I would recommend this book if you haven't done much computing in other languages.

Buy from amazon.co.uk   Buy from amazon.com

"C++ Primer" by Stanley B. Lippman, Josee Lajoie, Barbara Moo. This is an introduction to C++ but it is really suited to someone who is very competent in other programming languages. So if you are au fait with programming and want something that will get you going quickly buy this. It's a classic and has sold over half a million copies.

Buy from amazon.co.uk   Buy from amazon.com

"Thinking in C++' by Bruce Eckel. This two volume set is about how to use the C++ language properly and aim to teach you the right way to think about C++. In this it succeeds. It is, however, hard going for those who do not know C, and the author assumes some knowledge of that language. It's long and a lot of hard work but if you work through it, you will really know how to program in C++.

Buy from amazon.co.uk   Buy from amazon.com

Topic books

Once you've got the basics, there are a number of books that aim to get you from the novice level to the intermediate level. These generally discuss small topics one by one rather than trying to be comprehensive.

"Effective C++", "More effective C++" and "Effective STL" by Scott Meyers. Effective C++ was one of the first books to really discuss how to use C++ as a language rather than focussing on the syntax. Meyers' style is to give you lots of informal advice about the right way to do things and in my experience, if Scott gives you a guideline you really ought to follow it.

Buy from amazon.co.uk   Buy from amazon.com

"Exceptional C++", "More exceptional C++", "Exceptional C++ style" by Herb Sutter. The author presents problems, invites the reader to solve them, and then generally demonstrates that the reader doesn't understand C++ nearly as well as he thought. There is a particular focus on writing exception-safe code -- hence the title. Whilst the presentation can be irritating at times, and I don't buy some of his advice, Sutter will definitely improve your understanding of C++.

Buy from amazon.co.uk   Buy from amazon.com

"Large-Scale C++ Software Design" by John Lakos. Ever had a large project that turned into spaghetti, or had a project where you were afraid to change certain files because of the time it would take to rebuild the project. This book is on how to avoid such problems by organizing your code correctly from the start. Whilst the book is a little-dated and there's a certain amount of overlap wth Sutter's books, it's still a good read.

Buy from amazon.co.uk   Buy from amazon.com

"The C++ Standard Library: A Tutorial and Reference" by Nicolai M. Josuttis. C++ ships with a lot of classes and algorithms; these are called the Standard Library. Learning to use them properly will make your code quicker to develop, more robust and more efficient. Reading Josutti is a great way to do the learning.

Buy from amazon.co.uk   Buy from amazon.com

"C++ Templates: The Complete Guide" by David Vandevoorde, Nicolai M. Josuttis. Everything you ever wanted to know about templates and quite a few things you didn't. Templates in C++ have gone way beyond their designers' original intention of providing a way of doing generic programming to being a method of doing computations at compile time. This book is the definitive book on the topic.

Buy from amazon.co.uk   Buy from amazon.com

Reference books

There are certain books that you should own and consult but shouldn't try to read from cover to cover.

"The C++ Programming Language" by Bjarne Stroustrup. This is the definitive guide to the language from the guy who invented it. Very useful but paedagogy is not Bjarne's strength.

Buy from amazon.co.uk   Buy from amazon.com

"The C++ Standard: Incorporating Technical Corrigendum No. 1" by British Standards Institute. This has to be

one of the driest books ever written, but sometimes you really want to know what the "legal" rule is for some piece of C++ and this book is then great.

Buy from amazon.co.uk   Buy from amazon.com

C++ and quant finance

There are by now at least 5 books on this. I like my own, of course. I haven't read most of the others.

Erik Schlogl's book is sufficiently good that I endorsed it on the cover. It's more computational finance with the C++ code than a book on C++, however.

The books by Brooks and London are not recommended.

Background

None of these books are essential reading, but they will all give you some idea of what goes on in banks and stop you being appalling ignorant of the background before you go for interviews. They can also help solve the problem of what to say when your parents ask what you do for a living...

"My life as a quant: reflections on physics and finance" by Emanuel Derman. The author was one of the first quants and was fortunate enough to work under Fischer Black at Goldman Sachs. He takes us through his career in both physics and finance. Whilst he is a not natural writer, he lived through interesting times and this book is a natural read for the wannabe quant. My favourite part is when he describes cheering at the news that his lab has been burnt down, and the perplexed reactions of his family to this. Another resonant part is when he talks about how sitting in his office one day as a post-doc, he feels envious that the post-doc in the office has been invited to go to France: originally he had wanted to be the next Newton, now his ambitions are rather smaller...

Buy from amazon.co.uk   Buy from amazon.com

"Liar's poker" by Michael Lewis. The author's account of life at Salamon Brothers in the 1980s. If you want to understand the excesses of Wall Street in boom years, this is the book to read. Most bankers have read this book at one time or another and the terminology and stories are legends.

Buy from amazon.co.uk   Buy from amazon.com

"When Genius Failed: The Rise and Fall of Long Term Capital Management" by Roger Lowenstein. How one hedge fund almost brought on the global financial crisis ten years early by taking their mathematical models far too seriously. The cast of characters overlaps with that of "Liar's poker."

Buy from amazon.co.uk   Buy from amazon.com

"Wriston: Walter Wriston, Citibank, and the Rise and Fall of American Financial Supremacy" by Phillip L. Zweig. The biography of the former CEO of Citibank. This is really a history of modern banking. If you want to understand the evolution of the modern banking system, this book is great.

Buy from amazon.co.uk   Buy from amazon.com

"Fooled by randomness" and "the Black Swan" by Nassim Taleb. The author's thesis in the first book is that much of apparent skill is really luck. We only see those that were lucky and they interpret their fortune as being due to their skill, whilst those who were unlucky pass out of view. In the second book, he focuses on the fact that any mathematical theory cannot quantify the truly unexpected and so whilst one can produce marvellously detailed mathematical models, it is the events not catered for in the model that truly sink banks. Taleb's writing style and verbosity can be irritating, but these two books have become such a part of the modern folklore of banking that you have to have read them even if it is only so you can say why you think they are nonsense.

Buy from amazon.co.uk   Buy from amazon.com

"The poker face of Wall Street" by Aaron Brown. I am not a huge fan of this book since it requires a great deal of interest in poker which I do not have. However, if you like poker or want a different take on how modern finance functions, it's worth buying.

Buy from amazon.co.uk   Buy from amazon.com

"The Partnership: The Making of Goldman Sachs" by Charles D. Ellis. A history of Goldman Sachs from its beginnings up to its flotation. This books gives a lot of insights into the culture of a firm that's known for high rewards and very long working hours.

Buy from amazon.co.uk   Buy from amazon.com

"How I Became a Quant: Insights from 25 of Wall Street's Elite" edited by Richard Lindsey and Barry Schachter. This book says that I am famous on the first page so it must be good! Other than that it's a good book to read to get some idea about what working quants are really like. Each of 25 quants has written a chapter about their life stories.

Buy from amazon.co.uk   Buy from amazon.com

back to www.markjoshi.com

Legal stuff: