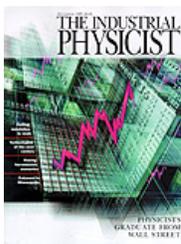


# Finance for Physicists

This page arose because I am often asked for advice and suggestions about how to prepare for, and get a job on Wall Street as a quantitative analyst. Everything here is subjective and personal opinion, but I hope that you will find it useful. I've listed some educational resources, ways to start looking for jobs, and provided some links to differing perspectives on the way in which quantitative modeling has influenced the financial crisis.

## *What do physicists actually do on Wall Street?*

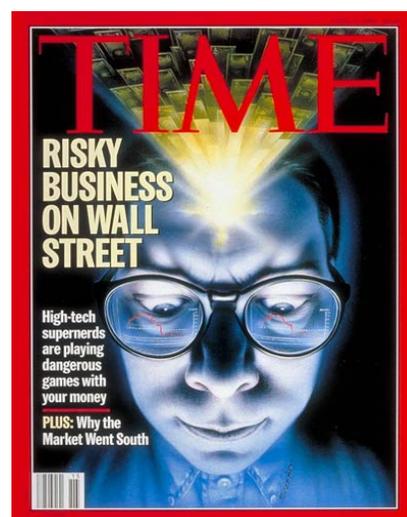
[Here](#) is a good article from the Dec 1999 issue of [The Industrial Physicist](#) magazine, which describes the impact physicists are having on Wall Street (bear in mind that it was written well before the credit crunch):



## *Risky business on Wall Street?*

There is no doubt that physicists and "quants" make a real difference to the way in which Wall Street works in the 21st century. [Read more about the trends and the dangers ...](#) some of which turned out to be rather prophetic. Or did they? Are physicist quants really to blame for causing the global systemic crisis that emerged on the public's radar screen during 2008? [Here is a different viewpoint](#), describing the problems and counter-productive incentives inherent in the current financial system. You can read an industry perspective on this [here](#), focused more on the need for consumers of financial products to understand what they are buying. The curious thing about the role of physicists is that although they are educated to *model* nature, their role on Wall St. is primarily to *calculate* using descriptions of markets devised by financial economists. Such models are based on assumptions that have been overly-simplified to make them analytically tractable, as described in [this article](#). Physicists' attempts to re-examine financial markets can be followed at the [quantitative finance archive](#), launched in Dec. 2008.

During 2006, a special workshop was held on [New Directions for Understanding Systemic Risk](#), organized under the auspices of Timothy Geithner (presently US Secretary of the Treasury) at the New York Federal Reserve and the National Academy of Sciences. The workshop highlighted the lack of preparedness of the global financial system for dealing with systemic risk, and showed clearly the need for a scientific, complexity-based assessment of the problem. At the workshop, the beginnings of research in this direction were presented, and you can read a perspective on that in a summary ["Ecology for Bankers"](#) written by Robert May, Simon Levin and George Sugihara. The workshop report is in the public domain and makes interesting reading: it can be downloaded for free or read online from the [National Academies Press website](#).



## *Physics with finance at the University of Illinois at Urbana-Champaign*

In order to provide a cheap and easy way for physics students at my home institution to become knowledgeable in finance, I created a course option that yields a Masters in Finance for Physics students. Students registered for the University of Illinois Physics Ph.D can be enrolled in the Masters in Finance program, and receive credit for their physics courses. In other words, you can get a Masters in Finance for relatively little extra work. This is highly recommended for students contemplating a career as a quant on Wall Street. Unfortunately, this option has been discontinued at the time of writing (2008).

### *Courses at other universities*

There are many courses offered in computational finance at academic institutions. A partial list is given in [this article](#) from the July 1999 issue of RISK magazine. They offer useful training, of course, but if you are thinking of taking one of these programs, I suggest that you bear in mind the cost, the opportunity cost, and the fact that many of the physicists currently working on Wall Street are self-trained and apparently able to do their jobs.

## *Job hunting on Wall Street*

To get a job on Wall St., it is essential to be well-prepared and knowledgeable about financial derivatives. The days are over when you could get in with no knowledge and expect that your physics Ph.D would be enough. A useful qualification is to do a Masters of Finance course, if your institution permits it. This may not go far enough however, and more advanced reading should be done.

A fun place to start is the ingenious [Comix](#) series, from the trade magazine [Derivatives Strategy](#).

It is also worth doing a summer internship at one of the major investment banks. Since entrepreneurial spirit is one of the qualities that they prize, I will let you figure out how to arrange that ...

### **Books**

If you are contemplating a career in quantitative finance, you should know something about the business, and something about the technical aspects of

derivative securities. Here are some recommended books on both these topics, starting with the technical books:

- J. Hull, *Options, Futures and Other Derivatives (3rd edition)*. Previous editions were called *Futures, Options and other Derivative Securities*. In the mid 1990's this was the only book available, and it is still useful and has been somewhat updated. Most physicists will, however, feel that the presentation is too heuristic.  
**Compulsory reading.**
- Neil Chriss, *Black-Scholes and Beyond: Option Pricing Models*. Excellent overview of modern day finance, financial models, and their shortcomings. A great blend of practical and theoretical knowledge, clearly presented.  
**Compulsory reading.**
- J.-P. Bouchaud and M. Potters, *Theory of financial risk and derivative pricing: from statistical physics to risk management*. Probably the best book I have seen in the "econophysics" field, focusing not on the standard quantitative finance calculations (i.e. the stuff that actually gets you a job on Wall Street), but on the far more interesting and important aspect of better modeling of financial markets. The authors have lots of real world experience, as well as being excellent physicists, so this is a great transition book for lapsed physicists to read.  
**Recommended reading.**
- P. Wilmott et al., *Option Pricing*. Presents option theory from the differential equation point of view, with little stochastic differential equation theory. Some emphasis on simple numerical methods. Beware: poor discussion of interest rate derivatives.  
**Accessible introduction for physicists, but not sufficient on its own.**
- M. Baxter and A. Rennie, *Financial calculus*. A very good and readable introduction to stochastic differential equations, martingale theory and option pricing. The emphasis complements Wilmott et al., and the writing is clear and lucid, and occasionally entertaining.  
**Recommended reading.**
- D. Shimko, *Finance in continuous time: A primer*. Lucid and crisp presentation of stochastic calculus with lots of examples on which to practice manipulations.  
**Recommended reading.**
- P. Jorion, *Value at Risk*. An elementary introduction to modern day risk management and the concept of value-at-risk.  
**Suggested reading.**

Here are some books that will give you a general background and are definitely worth reading if you intend to make this your career. I know of at least one talented individual who was somewhat dazzled by Wall St, but eventually realised that it was not what he was looking for in life, and returned to academia as a result.

- E. Derman, *My Life As a Quant*. A personal memoir of one physicist's journey from academia into quantitative finance. Derman's account is both a cautionary tale about the challenges of scientific and academic life and a realistic perspective about the "glamour" of Wall Street. Derman avoids superficial gloss and is refreshingly frank about the rewards and limitations of a career in quantitative finance. Recorded with equal candour are the author's limited successes in physics, the despair and loneliness of parts of his life, the invigorating success of parts of his work at Goldman, Sachs, and his dissatisfaction with some aspects of his career on Wall Street. The book is particularly successful where it describes the physical intuition he used to develop his most substantial contributions to financial modeling: interest rate dynamics, and the volatility smile. I found this part skillfully written, particularly as it highlights the point I personally make in my own presentations: that the greatest value physicists can potentially provide to Wall Street is better modeling, rather than better and faster calculations on wrong or ill-founded models. Another important lesson from the book is the value of listening to the "customer" (in this case, traders), for whom an easy to use graphical interface is more important than all the math in the world. Derman's book is a must-read for would-be quants and academic physicists.  
**Compulsory reading.**
- Satyajit Das, *Traders, Guns and Money: Knowns and Unknowns in the Dazzling World of Derivatives*. The author is an authority on swaps, but in recent years has been something of a whistleblower --- " Like an ex-mobster turning state's witness ..." in Jon Markman's [memorable characterization](#). *Traders, Guns and Money* describes all aspects of the financial derivatives world, at least as it existed prior to the credit crisis. Unlike some of the other books below, this one is a warts-and-all account, and the picture that emerges is not a pleasant one. Many ex-physicists becoming quants will not necessarily understand the workings of the system as clearly as Das lays them out, and so this book is an excellent preparation for the realities of the world of Wall Street. Das writes very well, and has an excellent sense of humour which will appeal to those with a cynical bent.  
**Compulsory reading.**
- G.J. Millman, *The Vandal's Crown*. A rather breathless account of the history of finance. The two chapters on "Nuclear Finance" and "Risk Management" are the most pertinent, describing modern day Wall St. Informative and easy to read.  
**Recommended reading.**
- P. Bernstein, *Capital Ideas*. A readable history of financial economics, from Markowitz, who developed the theory of portfolio optimization to the more recent growth of the derivatives markets.  
**Recommended reading.**
- Frank Partnoy, *F.I.A.S.C.O.* A completely "gloves off" description of the dark side of Wall St, which has provoked predictable denials from the industry. The author worked for several years on Wall St., not as a quant, but as an investment banker, designing sophisticated derivatives products at Morgan Stanley and CS First Boston to enable clients to hide investment losses, make risky bets on forbidden categories of investments etc. Controversial, scurrilous, cynical, almost libellous, and amusingly written in parts. The narrative ends with the author leaving Wall St. after realising that "everyone I knew who had been an investment banker for a few years, including me, was an asshole".  
**Recommended reading.**

- Roger Lowenstein, *When genius failed*. A very readable account of the failure of Long Term Capital Management, widely regarded as the preeminent hedge fund on account of the stellar reputations of its principals, two of whom were Nobel laureates. LTCM's disastrous performance in the summer of 1998 threatened to cause a systemic collapse of the world's capital markets. [More ...](#)  
**Compulsory reading.**

## Getting a job

The most efficient way to get a job is to contact a headhunter (see below). However, you might want to take a look at some other resources to get some idea of what is out there. [This Google search](#) will bring up many useful links.

You can also go through a headhunter. [This Google search](#) brings up many useful links.

Here is the contact information of headhunters with whom I or colleagues have had some contact in the past. I have no idea if these contacts are still active. Disclaimer: by providing these numbers below I am not making any recommendation about the quality of these individuals, and this list should not be considered any sort of endorsement of the services they provide.

Barry Franklin  
Integrated Management Resources  
51 West Elliot Rd., Ste 108  
Tempe, AZ 85284  
ph. (480) 460-4422  
fax (480) 460-4424  
[barry@integratedmgmt.com](mailto:barry@integratedmgmt.com)

Bob Long  
Denison Group  
551 Madison Avenue,  
New York, New York 10022  
ph. (212) 588-8883  
[boblong@denisongroup.com](mailto:boblong@denisongroup.com)

Thomas Gan  
Options Group  
(212) 982-8359  
[tgan@optionsgroup.com](mailto:tgan@optionsgroup.com)

Joshua Bloom  
Cyperus Group  
(212) 300-6457 x107  
[jbloom@cyperusgroup.com](mailto:jbloom@cyperusgroup.com)

Ed Vertucci  
WidePoint Corp.  
(630) 953-6520  
[evertucci@widepoint.com](mailto:evertucci@widepoint.com)

Note: The company primarily works in the Chicago area.

Jim Brescoll  
Columbia Technology Corporation  
(212) 280-5500  
[jbrescoll@columbia-tech.com](mailto:jbrescoll@columbia-tech.com)

Here are other headhunters whose numbers I have been given in the past, but I have had no personal contact with them. Disclaimer: by providing these numbers below I am not making any recommendation about the quality of these individuals, and this list should not be considered any sort of endorsement of the services they provide. I do not even know if all the numbers below are correct.

Beth Akins (212) 759-6400  
Jaime Fields (212) 513-7777  
Scott Gerson (212) 986-3344  
Linda Greenberg (212) 286-9409  
Robin Isacson (212) 254-4452  
Jiin Kang (212) 947-7114  
Deborah Kolb (818) 999-9891  
Tom Morgan (212)513-7777 (ext 358)/ [tom@pencom.com](mailto:tom@pencom.com)  
Steven Popper (212) 719-0101  
Steve Newman (212) 687-9696  
Bob Reed (212) 378-4830  
Daniel Raz (212) 545-8511  
Gail Tudisco (212) 980-1411  
Dina Wehn (212) 675-3224

I would suggest that before you get in contact with a headhunter, have a resume prepared, and do the appropriate readings in finance. Since most of the places will actually ask questions and trick questions related to options, one has to be both prepared and show them that you are serious and have undertaken the necessary steps. Also things usually progress rather quickly; you may be expected to go for an interview within two weeks.

## Getting a job: Interviews

Interviews on Wall Street have two goals, primarily: (1) To see if you are bright and can think on your feet quickly and accurately; (2) To see if you have any background knowledge about finance. Goal (1) is usually accomplished with brainteaser questions that have no finance content. Goal (2) is usually accomplished by seeing if the candidate's proclaimed expertise survives a reality test. I once interviewed a candidate who claimed extensive familiarity with interest rate models but was unable to write down the stochastic process for the Hull-White model. If you are thinking of working on Wall Street, and do not know the answer to this simple question yourself, consider that the interest rate derivatives market is the largest in the world: for example, [according to the US Treasury](#), the notional value of interest rate derivative securities held by US commercial banks at the end of the 4th quarter 2004 was \$76 trillion. You might enjoy comparing this number with the US gross national product (GNP).

Excellent advice on how to *give* an interview is available [here](#) (along with lots of other useful advice), and this can also be used to the advantage of the interviewee.

[Here is a website](#) that has some good brain teasers to practice on: these brainteasers test your ability to construct and understand algorithms for challenging problems that are unfamiliar.

Here is a new book that contains specific interview advice for those being interviewed for quantitative positions on Wall Street:

[Heard on the Street : Quantitative Questions from Wall Street Job Interviews by Timothy Falcon Crack.](#)

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Nigel Goldenfeld  
*Updated October 2013*