From Physics to Finance:
What Does a Quant Say?

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Outline

- Quantitative analysis in finance requires many of the skills of today's physics and math graduate students.
- The market environment is ever changing via new technologies, instruments, and regulations.
- How have quantitative strategies weathered the upheaval in the finance industry over the past six years?
- Is the culture in finance different or similar to academia?
- How does one successfully transition to finance?
- A career choice that physicists and mathematicians have been gravitating towards for decades.
The mathematical links between Physics and Finance

- 1900: Louis Bachelier’s *Theory of Speculation* - used a random walk to analyse fluctuations on the Paris stock exchange.
- 1905: Einstein uses Brownian motion to describe pollen suspended in water.
- 1973: Fischer Black & Myron Scholes: The pricing of options
- 1990: Black–Derman–Toy model of short term interest rates
Environment: 2007-Now

- Aug ‘07: Meltdown begins with a major bank blocking withdrawals from 3 Hedge Funds
- GFC of 2008
- New regulations: Dodd-Frank Reform Bill
- Quantitative Easing
- US stock markets at all time highs again
- Capital gains tax increase
- Economic recovery weak but steady
- 2013: Hedge fund industry recovering to levels pre-GFC
Who, What and Where

○ Who needs PhDs:
  ○ hedge funds, "quant shops"
  ○ investment banks
  ○ proprietary trading firms, "prop shops"
  ○ research firms

○ Quantitative finance positions:
  ○ quant researcher, developer, back-office/risk quant, front-office/desk quant
  ○ trader, fund manager

○ New York, Chicago, London, Hong Kong
Why physicists?

○ Analytical, inquisitive, problem solver, work independently, etc., etc.,...

○ Skill set match - Bingo!
  ○ math
  ○ programming
  ○ handling large data sets
  ○ modeling

○ Other fields of science and math require these skills - not just physicists hired
What's it like?

- Culture varies greatly - specific to firm/group
- Hours: typically market hours, "9-5"
- Support structure: team of developers, sys admins, help desk personnel
- Significant thought on research direction
- Timelines much shorter than academia
- Most projects are proprietary, the firm's IP
- Connection to Academia, finance journals
- A typical day in the life of a quant
What does it take to transition?

○ Knowledge of industry helps
  ○ Be familiar with historic and current events
    ■ 1987 Stock Market crash
    ■ LTCM collapse in 1998
    ■ May 2010 Flash Crash
  ○ Understand derivatives (options, futures)
  ○ You are not expected to be a finance expert but must show interest

○ Read, read, read

○ Network, network, network

○ Contact a quant recruiter

○ Know thyself - where you might fit in?
Skills required

○ Coding: C/C++, C#, Java, Python, VB
  ○ strength in C/C++ is often necessary
  ○ will likely have to learn another on-the-job

○ Stats/modeling language/software packages
  ○ Numpy/SciPy (python)
  ○ R
  ○ SAS, Statistical Analysis System
  ○ Matlab

○ Database query language, eg., SQL

○ Math: probability, statistics, time series analysis, signal response analysis, PCA
Skills continued...

- More math and modeling: stochastic calculus, Monte Carlo, linear regression
- Understand pricing and risk models and their limitations
  - Black-Scholes option model
  - Value at Risk (VaR)
- Soft skills:
  - ability to communicate complex ideas !!!
  - work independently, but also work well with others
Preparing for an interview

○ Refresh your maths - you will be tested
○ Clear and concise description of your research - you will be asked
○ Developer
  ○ know the standard libraries and structures in C++
  ○ know your algorithms: sorting, random, shortest path
○ Did you use Root, Matlab in your research? look under the hood
  ○ what kind of regression and why?
○ You may be given a homework project
Achieving success

○ Communicate complex ideas well
○ Know the limitations of maths, models, algos
○ Balance thoroughness with timeliness
○ Don't overfit the data!
○ Bring new ideas, new sources of alpha
  ○ quantify human behaviors
  ○ Twitter feeds ?
  ○ AP, Thomson-Reuters news feeds
○ Build market intuitions
○ Start your own group within firm
Resources

○ Books
  ○ *The Quants*, Scott Patterson (WSJ)
  ○ *My Life as a Quant: Reflections on Physics and Finance*, Emanuel Derman
  ○ *Options, Futures and Other Derivatives*, John C. Hull

○ Websites
  ○ quantfinancejobs.com
  ○ topcoder.com: algorithm tutorials
  ○ wilmott, quantnet: Quantitative finance community
  ○ "Learning from Data", Yaser Abu-Mostafa, Caltech Machine Learning class lectures, on youtube
  ○ ftalphaville.ft.com - finance news, blog, commentary