Prepare for a Career in Investment Management Workshop Series
Cornell Career Services

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Every Thursday in February
4:30PM Stimson Hall G01

TODAY: QUANTITATIVE FINANCE
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Modern Markets and How to Prepare for Quant Finance Interviews

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Disclaimer

The presentation is intended for a general public and some of the real-world concepts in finance will be over-simplified in an informal manner, to make them intuitive and understandable.
1. How did the financial market become so complex?

2. How is it possible to generate profits in the financial market?

3. What set of skills do you need and where is it optimal for you to go to work?

4. How to prepare for a quantitative finance interview?
Agenda

1. History and the Evolution of (Equity) Markets

2. Is there an alternative to “Stock Pitching”
   I. Quality and Behavioral Biases
   II. Risk and Diversification
   III. Value & Momentum
   IV. Derivatives

3. Preparing for Interviews
History and the Evolution of Equity Markets
The Story of a Company

- Once upon a time, there was a company
- Who decided to raise money by issuing equity
The Story of a Market

• It is possible to buy/sell the equity
• Why not to have a place where to buy and sell equities and other financial instruments?
  – Stock Exchange (NYSE, NASDAQ)
The Story of a Market

• Stock Exchanges
  – Price Discovery
  – Transparency
  – Liquidity

• Market Efficiency!

How to generate profits?
Fundamental Traders

• The better the company, the higher will be its stocks values
  – How to determine the health of the company?
Information

- Analyst Reports
- Corporate Calls and Corporate Events
- Global Macroeconomic Situation
- Accounting Data
- Financial Ratios (systematic?!) 

- How to be better than the market?

Be an expert in a field!
Example

- Mr. Profits is an expert in the coal industry!
- He always knows which coal stocks to pick and has 7 best (out of 1000) stocks in his portfolio
- Suddenly, the world decided to be greener and new alternatives to coal were introduced!

- Mr. Profits lost 70% of his assets.
Idea: Diversification

- Have stocks from different industries in your portfolio
- Question: how related some companies are?
- Question: how related the whole economy in some countries are?
  - Concept: correlation
- If one has stocks that are not very correlated to each other, one might protect herself from sector downturns
Idea: Risk

- Which stock is better?

- Idea: volatility
Academia Came to Help!

- Markowitz Optimal Portfolio Construction Model
- Sharpe Ratio
- Capital Asset Pricing Model
- Fama and French 3 factor model

- At some point, academia concluded that the markets are efficient!
Information

• People, looking at information, trying to predict the health of the company and make investments that will be profitable

• Similarity in the approach: PEOPLE
Psychological Biases

• “It is so gloomy outside in the NYC, I don’t feel like making risky purchases now”
  – Weekend Effect, Holiday Effect

• “Analysts say the company is in trouble, the price is already down 30%, I will lose my job, sell, sell, sell!”
  – Fire sell and Market Rebound

• “This company is small, who cares about it”
  – Small Cap Effect

• “I am from Texas, the people there are amazing, and I know what’s happening there better than the others”
  – Home Bias
The birth of baby “systematic”

• Then ANOMALIES were discovered
  – Portfolio with low P/B financial ratio outperforms the market
  – Portfolio with stocks that outperformed the market for the last 12 months will continue to outperform the market

• IDEA: IF (fill in the blank) in the portfolio then it will outperform the market

• “IF RULE THEN PROFIT” – systematic
  – If the rule is simple, why can’t a computer perform trading?
More Complex Markets

• New Products: Derivatives
• Option to sell a Stock at a pre-determined price on a pre-determined day: how to price it?

• Option to sell a Stock at a pre-determined price **UP TO** a pre-determined day: how to price it?

• New financial information, accounting data, news, opinions, reports, macro data, GDP, oil prices!
  – **COMPLEXITY** that requires **full-time commitment**
Investment Professionals
Investment Professionals

• Pension Funds and Endowments

• Investment Banks

• Investment Management Companies
  – Hedge Fund Holdings: 3 trillion USD (2015)

• Indexes, ETFs
How to choose an investment manager?

• Sharpe Ratio

• Tracking Error

• Information Coefficient

• Active Share
How is it possible to generate profits in the financial market?
Stages of Systematic

• Determine the “health” of the company, economy etc. in a systematic way

• Find some patterns in the movement of stock prices and make a portfolio that will generate profits based on those patterns

• Utilize both the quality and patterns information, study how others trade and make a strategy that accounts all that information!
Patterns: Momentum Anomaly

- If you buy the stocks that outperformed the others for the last 12 months and sell the ones that underperformed you might make a profit.
- *Idea: if the stock value is increasing/decreasing for some time already, it is likely to continue to increase/decrease*
Patterns: Value Anomaly

• Underpriced Stocks
  – Stocks that have a high book value but for some reasons have relatively low price, will at some point catch up with the price

  – Reasons: highly debated in academia, probably based on the idea of risk premium
New Patterns:

• Value and Momentum based strategies are used by a large portion of the market

• Make a strategy that accounts for the fact that some strategies are used so broadly, and predict the equity prices better than the others (my research)
Other Strategies?

• HFT (market makers)

• Statistical Arbitrage (pairs trading)

• Long/Short (general class), Long Only

• Multi-Style Strategies

• Event-driven strategies, sentiment analysis
What can help to generate profits?

• Acquiring information from the market in a systematic way
  – Data Analysis, Programming
  – Natural Language Processing

• Finding profitable strategies
  – Econometrics, Statistics, Modeling, Probability
Is the whole market systematic?

**Fig. 2: Breakdown of Active Hedge Funds by Primary Strategy and Trading Style**

Source: Preqin Hedge Fund Analyst
Quantitative Equity Portfolio Management

- Alpha Model
- Risk Model
- Optimal Portfolio Construction Model
- Model Validation (model?!) 
- Data Collection
  - Sometimes exotic: news sentiment analysis of all the company quarterly letters
Preparing for a Quant Interview

• Knowledge of the field:

  – Active Portfolio Management (Grinold and Kahn)
  – Quantitative Equity Portfolio Management (Qian, Hua and Sorensen)
  – Options, Futures and other derivatives (John Hull)

  – Derman: My Life as a Quant: Reflections on Physics and Finance
Preparing for a Quant Interview

• Knowledge of useful subjects:
  – Machine Learning
  – Econometrics and Data Analysis
  – Natural Language Processing
  – Probability and Stochastic Processes
  – Programming, Data Structures and Algorithms
  – Economics, Psychology
Preparing for Quant Interview

• Interview Question Books:

  – Mark Joshi: Quant Job Interview Questions and Answers

  – Timothy Crack: Heard on the Streets

  – Xinfeng Zhou: A practical guide to quantitative finance interviews
Prefering for Quant Interview

- **Interview Question Types:**
  
  - Programming: C++, Matlab, Python, Knowledge of Algorithms
  
  - Data Analysis: statistics questions, what kind of projects have you completed, regression, time series
  
  - Logic, probability and math questions (maybe also option pricing if you indicated it on your resume)
  
  - Questions that prove that you are interested in finance (particularly if your field is completely unrelated)
Questions?