Designing, building and managing quantitative alpha strategies

The major value added of the active asset management and hedge fund businesses is alpha strategies. While qualitative alpha strategies are still important, in the past quarter century quantitative models for delivering alpha have seen most of the growth in assets under management.

This course will teach students the difference between a crank’s data-mined backtest with a Sharpe ratio of 8 and a professional alpha strategy that would interest an asset management firm, or could serve as the basis for opening a new hedge fund. Topics will include:

- Surveying the academic knowledge and practitioner experience with types of quantitative alpha strategies including long-term stalwarts that most quant managers use to areas of intense current research focus. We will also discuss “flash in the pan” ideas that generated a few papers but never went anywhere, perennial ideas that flop in practice, mathematical and financial errors that lead to illusory alpha and once-powerful strategies that have lost their edges.
- Identifying fundamental drivers of alpha. The course will be agnostic about types of explanations, focusing on teaching students to identify clearly and test skeptically explanations that are offered for alpha.
- Calculating the type of investment product and investor that are best fits for a particular alpha strategy, plus likely legal or capacity constraints. Known pitfalls of different types of strategy and quantitative alpha disasters will be covered.
- Distinguishing between well-known “alternative risk premia” (a.k.a. “hedge fund beta”) with the risk of crowding and novel alpha strategies with the risk of overfitting. Determining the correct balance based on goals.
- Balancing trading costs with execution efficiency with deviations from optimal portfolios.
- Estimating the infrastructure needs and costs of running an alpha strategy, as well as the necessary service providers, counterparties and brokers. Calculating minimum assets under management and performance necessary to make the strategy successful.
- Consideration of feedback effects including crowded trades, historical data contaminated by investors getting in and out of the strategy and what countervailing forces might be generated by the market if the strategy succeeds.
- Running the strategy from gathering data to estimating parameters, generating trades, monitoring performance and building in risk management.
- Selling the strategy to investors and any necessary third parties (prime brokers, trade counterparties, regulators). We will also discuss what separates a promising business idea that excites broad interest from a proposal that is dead in the water.

The main value of this course is to give students an in-depth knowledge of what a quantitative alpha strategy is, helping them to see the bigger picture if they decide to work for an asset manager or investor, or in a company that provides support to these activities such as a prime broker or software provider. For those students who wish to design their own quantitative alpha strategies—either now or in the future—it will serve as a mentored pilot project.
The course will use Antti Ilmanen’s *Expected Returns: An Investor’s Guide to Harvesting Market Rewards* as a text. We will cover parts I and III as a class. Students will be expected to select an elaboration of one of the strategies in part II for projects, or to come up with an independent idea if desired (but that will be considerably more work). The project is to produce a professional pitch-book for the strategy including theoretical support, specific design, backtest and realistic revenue and expense projections.

**Lecture 1**
Overview of asset management industry and the role of quantitative alpha strategies. Theories about why such strategies can work. High level overview of types of strategies and types institutions that exploit them. Historical and current performance of quantitative alpha strategies. Criticism of chasing alpha and of quantitative strategies.

**Lecture 2**
Overview of quantitative alpha strategies including equity, fixed income, mortgage, inflation, credit, commodity, FX, volatility and exotic or illiquid asset markets; with an orthogonal discussion of basic approaches including trend-following, value, relative value and arbitrage. These discussions will be necessarily high-level, but in the week following the lecture, students will be required to pick a specific topic for a deeper dive, and a project. Depending on class size, we may do individual or group projects.

**Lecture 3**
The first part of the class will consist of students doing very brief presentations of their proposed projects, with discussion and feedback from the class. The remainder of the class will consist of the necessary background work to begin the project: survey of academic literature, investigation of current and past implementations, analysis of current market conditions and gathering of necessary data for strategy design and backtesting. We will pay particular attention to ways to estimate strategy crowdedness and practices to mitigate the danger of data-mining.

**Lecture 4**
We will go into depth on data analysis for strategy design and backtesting. We will pay particular attention to cleaning data, selecting the appropriate scope of data, incorporating lower-quality or qualitative data to make conclusions more robust, problems of estimating execution prices and transaction and financing costs in the past, issues with proxy series where securities did not exist far in the past or for which specific data are unavailable.

**Lecture 5**
This lecture will be devoted to student presenting work to date on their projects with class advice and critiques. The last half hour will be a lecture on how to finish up the design and backtest, and get to started on the remaining materials due.

**Lecture 6**
This will cover turning a strategy with backtest into a viable business plan and pitch book. We will discuss appropriate types of vehicle (hedge fund, ETF, sleeve of a multi-strat fund, public mutual fund, direct investment by an institution or other), target investors, necessary partners and counterparties.
and what will attract good ones, competition, protecting intellectual property, costs and pricing. In
addition to general material, the lecture will address specific questions that come up in various projects.

Lecture 7
Students will present their project pitch books with the class acting as potential investors. I will also
present a mock pitch book myself. Students will be graded on their written project (60%), project
presentation (20%), participation in class discussions (10%) and a written reaction to my mock
presentation they produce as a take-home exam.

Aaron Brown
I have run quantitative alpha strategies for Lepercq, de Neuflize, Prudential Insurance and on my own
account in mortgage-backed securities, equity derivatives and FX derivatives. For the last ten years I
have been Chief Risk Officer at AQR Capital Management, one of the largest quantitative alpha asset
management companies. Working as a risk manager at Morgan Stanley, Citigroup and Rabobank in the
prior ten years, I devoted significant time to designing risk management controls for quantitative
strategies pursued for the bank’s account as well as for customers in their asset management units, plus
overseeing the exposure to quantitative strategies from the prime brokerage units and a counterparty
credit risk standpoint.

I have an SB degree in applied mathematics from Harvard, and an MBA in finance and statistics from the
University of Chicago. I have worked in quantitative finance in various roles since the early 1980s, and
invested regularly in hedge funds since that time. I have been a regular columnist for *Wilmott Magazine*
on quantitative finance since inception, have written many papers for the professional literature and
SSRN and won the 2011 GARP Risk Manager of the Year award.

I wrote *Financial Risk Management for Dummies* (For Dummies, 2015), *Red-Blooded Risk* (John Wiley &
*The Poker Face of Wall Street* (John Wiley & Sons, 2006) and am working on two forthcoming books as
yet untitled: one editing Fischer Black ephemera in my possession (letters, course outlines, unpublished
articles, his market newsletters, memos and my discussion notes about his work and other ideas) and
one on risk management for artificial intelligence and machine learning strategies.

I have contributed chapters to *Fischer Black and the Revolutionary Idea of Finance* (preface, John Wiley
& Sons, 2011), *The Number that Killed Us* (John Wiley & Sons, 2011), *Counterparty Credit Risk* (Risk
Models on Models* (John Wiley & Sons, 2007), *The Best of Wilmott II* (John Wiley & Sons, 2006) and *The
Best of Wilmott I* (John Wiley & Sons, 2005).

I have done extensive adjunct teaching at Fordham University and Yeshiva University, covering a variety
of introductory and advanced topics in finance and statistics.