

# Advanced Risk and Portfolio Management

One Week, Heavily Quantitative, Omni-Comprehensive, Buy-Side Bootcamp

by **Attilio Meucci**

August 13-18, 2012

New York University - Kimmel Center, 60 Washington Square South, New York City

[symmys.com](http://symmys.com)

## What you get

- ✓ **Knowledge:** in-depth understanding of buy-side modeling from the foundations to the most advanced statistical and optimization techniques, in six intensive days of theory and MATLAB live examples and exercises
  - **Market modeling:** random walk, ARMA, GARCH, Levy, long memory, stochastic volatility
  - **Multivariate statistics:** non-parametric, non-normal MLE, shrinkage, robust, Bayesian estimation; copula/marginal factorization; location-dispersion ellipsoid
  - **Factor modeling:** theory and pitfalls of time-series and cross-sectional factor models, CAPM, APT, principal components analysis, random matrix theory
  - **Pricing:** full evaluation, Greeks, stress-matrix interpolation; analytical, Monte Carlo, historical
  - **Risk analysis:** diversification, stochastic dominance, expected utility, Sharpe ratio, Omega, Kappa, Sortino, value at risk, expected shortfall, coherent and spectral measures
  - **Portfolio construction:** robust/SOCP optimization, shrinkage/Bayesian allocations, Black-Litterman and beyond; transaction costs, liquidity, market impact; statistical arbitrage; convex/concave dynamic strategies, CPPI, delta-replication
- ✓ **Textbook:** *Risk and Asset Allocation* - Springer by Attilio Meucci
- ✓ **Code:** full set of case studies; temporary MATLAB license
- ✓ **Certification:** All attendees will be awarded
  - 40 credits - CFA Institute Continuing Education Program
  - 40 credits - GARP Continuing Professional Educational Program
  - Certificate of Attendance - Advanced Risk and Portfolio Management Bootcamp
  - Certificate in Advanced Risk and Portfolio Management (optional)
- ✓ **Meet the stars:** Almgren, Carr, Derman, Dupire, Litterman, Mercurio, more...

## What you pay

**\$850** (Academic/Student); **\$1,200** (Partner); **\$1,550** (Professional); **group rates** (contact us).  
After expenses, profits will be donated to charities.

## Audience

- ✓ Finance professionals with quantitative background
  - Portfolio managers/risk managers on the buy-side will learn the latest developments in the field and deepen their knowledge of mainstream approaches
  - Sell-side professionals will bridge the gap to quantitative buy-side finance
- ✓ Academics and students

## Instructor

**Attilio Meucci**, PhD, CFA.

Chief risk officer, Kepos Capital LP. Author, *Risk and Asset Allocation* - Springer. Regular contributor to *Risk Magazine*, *GARP Risk Professional Magazine*

## Registration / information

[symmys.com](http://symmys.com)

**Day 1 – Monday, 13 August 2012**

Day 1 – Monday, 13 August 2012	
Morning Session	Afternoon Session
<p style="text-align: center;"><b>Introduction/Quest for Invariance</b> (8:30-12:30)</p> <ul style="list-style-type: none"> <li>▪ <b>P vs Q: the worlds of quantitative finance</b></li> <li>▪ <b>The “Prayer”: modular steps of ARPM</b> <ul style="list-style-type: none"> <li>- P1: Quest for Invariance</li> <li>- P2: Estimation</li> <li>- P3: Projection</li> <li>- P4: Pricing</li> <li>- P5: Aggregation</li> <li>- P6: Attribution</li> <li>- P7: Evaluation</li> <li>- P8: Optimization</li> <li>- P9: Execution</li> <li>- P10: Ex-Post Analysis</li> </ul> </li> <li>▪ <b>Invariance and the random walk</b> <ul style="list-style-type: none"> <li>- Equities: log-returns</li> <li>- Fixed-income: changes in yield to maturity</li> <li>- Derivatives: (log) changes in vol. surface</li> </ul> </li> <li>▪ <b>Advanced dynamics in discrete time</b> <ul style="list-style-type: none"> <li>- Autocorrelation and AR(1) processes</li> <li>- ARMA processes and Wold's theorem</li> <li>- Long memory: fractional integration</li> <li>- Volatility clustering: GARCH</li> </ul> </li> </ul>	<p style="text-align: center;"><b>Quest for Invariance/Projection/Pricing</b> (13:30-16:00)</p> <ul style="list-style-type: none"> <li>▪ <b>Advanced dynamics in continuous time</b> <ul style="list-style-type: none"> <li>- Random walk: Levy processes</li> <li>- Autocorrelation: Ornstein-Uhlenbeck</li> <li>- Long memory: fractional Brownian motion</li> <li>- Volatility clustering: stochastic volatility</li> <li>- Volatility clustering: subordination</li> </ul> </li> <li>▪ <b>Projection to investment horizon</b> <ul style="list-style-type: none"> <li>- Analytical projection</li> <li>- Numerical projection: Fast Fourier Transform; simulations</li> <li>- Annualization of skewness, kurtosis, etc.</li> <li>- Square-root/linear risk ellipsoid propagation</li> </ul> </li> <li>▪ <b>Pricing at investment horizon</b> <ul style="list-style-type: none"> <li>- Full analytical: log-distributions</li> <li>- Full numerical: scenario pricing (Monte Carlo/historical)</li> <li>- Taylor approximation: theta-delta/vega- gamma; carry-duration-convexity</li> <li>- Stress-matrix approximation</li> </ul> </li> </ul>
<b>Review &amp; Exercises</b> (16:00-18:30)	
<b>Guest Lecture by Mark Carhart</b> (18:30-19:15)	

**Day 2 – Tuesday, 14 August 2012**

Day 2 – Tuesday, 14 August 2012	
Morning session	Afternoon session
<p style="text-align: center;"><b>Quest for Invariance II</b> (8:30-12:30)</p> <ul style="list-style-type: none"> <li>▪ <b>Multivariate statistics</b> <ul style="list-style-type: none"> <li>- Distribution taxonomy</li> <li>- Representations: pdf, cdf, cf, quantiles, scenario/probabilities</li> <li>- Spectral theorem / covariance visualization</li> </ul> </li> <li>▪ <b>Copulas</b> <ul style="list-style-type: none"> <li>- Copulas in theory</li> <li>- Copulas in practice: Copula-Marginal Algorithm</li> <li>- Panic copulas with Fully Flexible Probabilities</li> </ul> </li> <li>▪ <b>Multivariate dynamics</b> <ul style="list-style-type: none"> <li>- Multivariate Ornstein-Uhlenbeck process</li> <li>- Cointegration</li> <li>- Statistical arbitrage</li> </ul> </li> <li>▪ <b>Linear factor models</b> <ul style="list-style-type: none"> <li>- Systematic-idiosyncratic vs dominant-residual LFM's</li> <li>- Distributional r-square</li> <li>- Time-series, cross-sectional, statistical/PCA LFM's</li> <li>- Factor analysis</li> </ul> </li> </ul>	<p style="text-align: center;"><b>Linear Factor Models</b> (13:30-16:00)</p> <ul style="list-style-type: none"> <li>▪ <b>The five applications of LFM's</b> <ul style="list-style-type: none"> <li>- Multivariate estimation</li> <li>- Asset pricing theory</li> <li>- Search for alpha</li> <li>- Portfolio optimization</li> <li>- Risk attribution/hedging</li> </ul> </li> <li>▪ <b>LFM's case studies</b> <ul style="list-style-type: none"> <li>- Swap market: PCA and Fourier basis</li> <li>- Stock market: fundamental, macro, random matrix theory</li> </ul> </li> <li>▪ <b>Factor modeling pitfalls</b> <ul style="list-style-type: none"> <li>- Returns vs. invariants vs. P&amp;L</li> <li>- The idiosyncratic myth</li> <li>- CAPM vs. APT vs. LFM's</li> <li>- Time-horizon beta</li> </ul> </li> </ul>
<b>Review &amp; Exercises</b> (16:00-18:30)	
<b>Guest Lecture by Fabio Mercurio</b> (18:30-19:15)	

**Day 3 – Wednesday, 15 August 2012**

Morning session <b>Estimation I</b> (8:30-12:30)	Afternoon session <b>Estimation II</b> (13:30-16:00)	
<ul style="list-style-type: none"> <li>▪ <b>Estimators</b> <ul style="list-style-type: none"> <li>- General definitions</li> <li>- Evaluation: bias, inefficiency, error</li> <li>- Stress-testing</li> <li>- Generalized p-values, generalized t-statistics</li> </ul> </li> <li>▪ <b>Multivariate non-parametric estimators</b> <ul style="list-style-type: none"> <li>- Sample quantile and order statistics.</li> <li>- Sample mean/covariance and best-fitting ellipsoid</li> <li>- Sample factor loadings, betas, and OLS</li> </ul> </li> <li>▪ <b>Multivariate maximum-likelihood estimators</b> <ul style="list-style-type: none"> <li>- Normal hypothesis: sample estimators</li> <li>- Non-normal hypothesis: fat tails and outlier rejection</li> </ul> </li> <li>▪ <b>Shrinkage estimators</b> <ul style="list-style-type: none"> <li>- Stein mean</li> <li>- Ledoit-Wolf covariance</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Robust estimators</b> <ul style="list-style-type: none"> <li>- Assessing robustness: the influence function</li> <li>- Huber's "M" robust estimators: location, scatter and betas</li> <li>- Outlier detection and high-breakdown estimators</li> <li>- Minimum-volume ellipsoid and minimum-covariance determinant</li> </ul> </li> <li>▪ <b>Missing data</b> <ul style="list-style-type: none"> <li>- EM algorithm</li> <li>- ML marginalization</li> </ul> </li> </ul>	
	<b>Review &amp; Exercises</b> (16:00-18:30)	
	<b>Cocktail party</b> (18:30-21:00) See last page	

**Day 4 – Thursday, 16 August 2012**

Morning session <b>Risk Management I</b> (8:30-12:30)	Afternoon session <b>Risk Management II</b> (13:30-16:00)
<ul style="list-style-type: none"> <li>▪ <b>Portfolio aggregation</b> <ul style="list-style-type: none"> <li>- P&amp;L vs. returns</li> <li>- Holdings vs. weights</li> </ul> </li> <li>▪ <b>Risk attribution</b> <ul style="list-style-type: none"> <li>- Bottom-up approach</li> <li>- Factors on Demand</li> <li>- Portfolio-specific factor models</li> <li>- Non-Greek few-out-of-many hedging</li> </ul> </li> <li>▪ <b>Investor's objectives</b> <ul style="list-style-type: none"> <li>- Total return</li> <li>- Benchmark allocation</li> <li>- Net profits</li> </ul> </li> <li>▪ <b>Portfolio evaluation</b> <ul style="list-style-type: none"> <li>- Stochastic dominance</li> <li>- Satisfaction indices</li> </ul> </li> <li>▪ <b>Non-dimensional indices</b> <ul style="list-style-type: none"> <li>- Sharpe ratio, Omega, Sortino ratio, Kappa</li> </ul> </li> <li>▪ <b>Diversification</b> <ul style="list-style-type: none"> <li>- Review of common definitions</li> <li>- Conditional principal portfolios</li> <li>- Effective number of bets</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Expected utility and certainty-equivalent</b> <ul style="list-style-type: none"> <li>- Analytical solutions: mean-variance as satisfaction</li> <li>- Numerical solutions</li> </ul> </li> <li>▪ <b>Quantiles and value at risk (VaR)</b> <ul style="list-style-type: none"> <li>- Semi-analytical solutions in elliptical markets</li> <li>- Cornish-Fisher approximation</li> <li>- Extreme value theory (EVT)</li> <li>- Numerical solutions</li> <li>- Contribution to VaR from securities/factors</li> </ul> </li> <li>▪ <b>Coherent measures of performance</b> <ul style="list-style-type: none"> <li>- Expected shortfall (ES) and conditional value at risk (CVaR)</li> <li>- Contribution to ES from securities/factors</li> <li>- Spectral measures of performance</li> </ul> </li> <li>▪ <b>Stress Testing for estimation risk</b> <ul style="list-style-type: none"> <li>- Basic stress testing</li> <li>- Panic copulas with Copula-Marginal Algorithm</li> <li>- Fully Flexible Probabilities (time/state/entropy pooling conditioning)</li> <li>- Fully Flexible Bayesian networks</li> </ul> </li> </ul>
	<b>Review &amp; Exercises</b> (16:00-18:30)

**Day 5 - Friday, 17 August 2012**

Morning session <b>Portfolio Management I</b> (8:30-12:30)	Afternoon session <b>Portfolio Management II</b> (13:30-16:00)
<ul style="list-style-type: none"> <li>▪ <b>Constrained optimization: computationally tractable problems</b> <ul style="list-style-type: none"> <li>- Linear and quadratic programming</li> <li>- Second order and semi-definite cone programming</li> </ul> </li> <li>▪ <b>Two-step heuristics</b> <ul style="list-style-type: none"> <li>- Affine equivariance of expectation and covariance</li> <li>- Analytical mean-variance: two-fund theorem</li> <li>- Numerical mean-variance: quadratic programming</li> <li>- Mean-CVaR and alternative trade-offs</li> </ul> </li> <li>▪ <b>Benchmark vs. total-return portfolio management</b> <ul style="list-style-type: none"> <li>- Expected outperformance, tracking error, info ratio</li> <li>- Frontier in total-return coordinates</li> <li>- Frontier in relative-return coordinates</li> </ul> </li> <li>▪ <b>Pitfalls of mean-variance</b></li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Estimation risk</b> <ul style="list-style-type: none"> <li>- Allocation as a decision</li> <li>- Opportunity cost as loss of an estimator</li> </ul> </li> <li>▪ <b>Simple allocation techniques</b> <ul style="list-style-type: none"> <li>- Prior allocation: efficiency</li> <li>Sample-based allocation: unbiasedness</li> </ul> </li> <li>▪ <b>Robust allocation</b> <ul style="list-style-type: none"> <li>- Box uncertainty sets</li> <li>- Elliptical uncertainty sets (second-order cone programming)</li> </ul> </li> </ul>
	<b>Review &amp; Exercises</b> (16:00-18:30)
	<b>Guest lecture by Rob Almgren</b> (18:30-19:15)

**Day 6 - Saturday, 18 August 2012**

Morning session (8:30-12:30) <b>Portfolio Management III</b>	Afternoon session(13:30-16:00) <b>Portfolio Management IV</b>
<ul style="list-style-type: none"> <li>▪ <b>Multivariate Bayesian estimation</b> <ul style="list-style-type: none"> <li>- Theoretical background</li> <li>- Analytical solutions: Normal-Inverse Wishart model</li> <li>- Numerical solutions: Monte Carlo Markov Chains</li> </ul> </li> <li>▪ <b>Bayesian allocation</b> <ul style="list-style-type: none"> <li>- Predictive return allocation</li> <li>- Classical-equivalent allocation</li> </ul> </li> <li>▪ <b>Tactical portfolio construction</b> <ul style="list-style-type: none"> <li>- Rosenberg-Grinold</li> <li>- Black-Litterman</li> <li>- Black-Litterman for derivatives</li> </ul> </li> <li>▪ <b>Beyond Black-Litterman</b> <ul style="list-style-type: none"> <li>- Entropy Pooling and Fully Flexible Views</li> <li>- Non-normal markets</li> <li>- Non-linear views</li> <li>- Generalized stress-testing</li> <li>- Ranking allocation</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Dynamic allocation strategies</b> <ul style="list-style-type: none"> <li>- Convex/concave strategies</li> <li>- CPPI</li> <li>- Delta-replication</li> <li>- Drawdown control</li> </ul> </li> <li>▪ <b>Liquidity</b> <ul style="list-style-type: none"> <li>- Transaction costs</li> <li>- Market impact</li> <li>- Best execution</li> </ul> </li> </ul>
	<b>Guest lecture by Peter Carr</b> (16:00-16:45)
	<b>Review &amp; Exercises</b> (16:45-18:30)

## Cocktail Party - Wednesday, 15 August 2012

**18: 30 – 19:00: Buffet and refreshments**

**19:00 – 20:00: Guests**

19:00-19:10: Peter Carr - “Math by the Numbers”

19:10-19:30: Emanuel Derman - “Models.Behaving.Badly”

19:30-19:50: Bob Litterman - “Experiences of a P-Quant”

19:50-20:00: Bruno Dupire - “Experiences of a Q-Quant”

**20: 00 – 20:15: Buffet and refreshments**

**20: 15 – 20:35: Corporate Partners**

20:15-20:20: Chris Donohue, Director of Research and Educational Programs - GARP

20:20-20:25: Sebastian Ceria, Founder and Chief Executive Officer - Axioma

20:25-20:30: Andy Sparks – Head of Product Management - MSCI

20:30-20:35: Dan diBartolomeo – President and Founder - Northfield Information Services, Inc.

**20: 35 – 21:00: Buffet and refreshments**

## Corporate Partners of ARPM Bootcamp 2012

Affiliation with our partners grants a \$350 discount in tuition

