Understanding the Sources of Alpha

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Agenda

Two-stage approach to the investment management process:

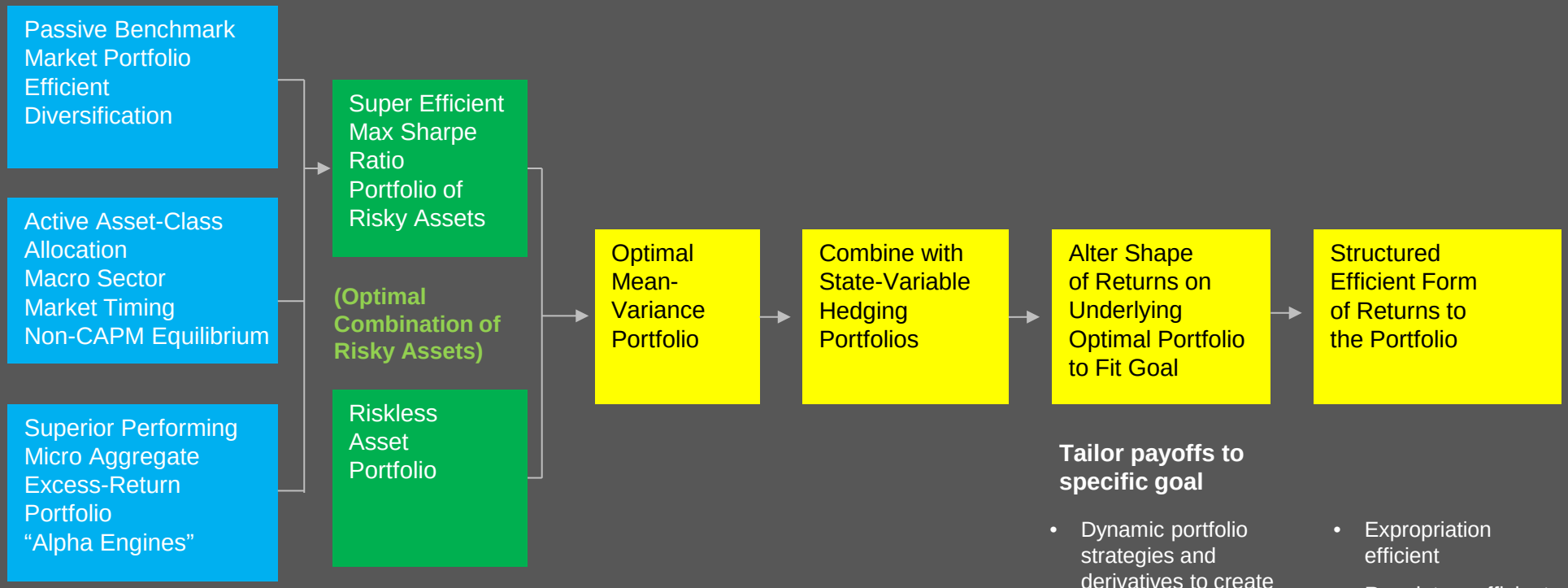
- Create the maximum Sharpe-ratio risky portfolio, Optimal Combination of Risky Assets (OCRA)
- Apply dynamic trading strategies between OCRA and the risk-free asset and/or use derivatives to optimize the portfolio for its specific goal

Creating OCRA

- Market cap-weighted portfolio: foundation component of the optimal combination of risky assets (OCRA)
- Failure of the CAPM implies market portfolio is not OCRA and therefore alpha exists relative to the passive market portfolio benchmark
- Sources of alpha: seeking to create superior performance over the market portfolio
- Traditional alpha vs. financial-services alpha: performance and sustainability
- Traditional alpha vs. dimensional alpha: performance and sustainability
- The search for dimensional alpha
- Hedge funds: a case study exploring alpha-source performance attribution
- Applying the three sources of alpha to improve asset management
- Global Diversification Pays: A “Free” Alpha

Domain of Investment Management

Stages of production process for a specified investment goal



- Components of max Sharpe-ratio risky assets-only portfolio
- Diversification risk modulation

- Risk modulation through hedging or leveraging risky portfolio
- Constrained asset holdings
- OCRA market timing active management

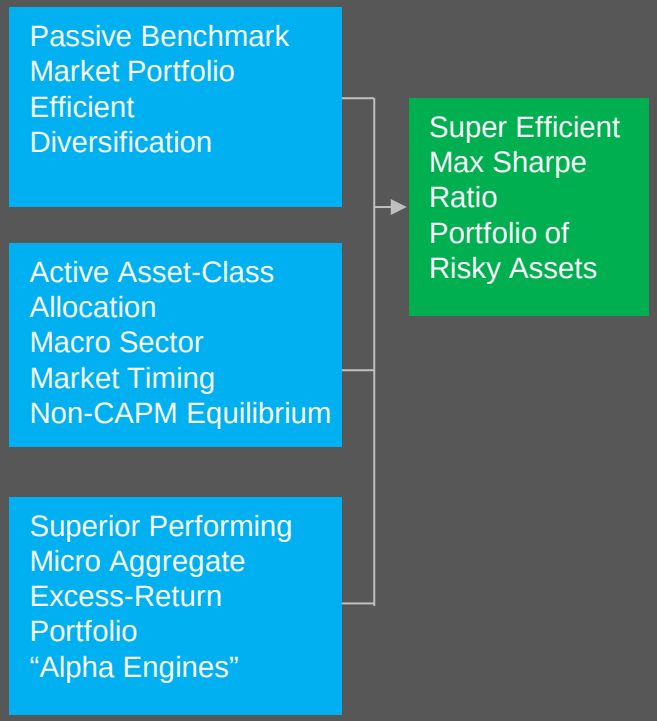
Tailor payoffs to specific goal

- Dynamic portfolio strategies and derivatives to create nonlinear payoffs
- Risk modulation with insurance or non-linear leverage
- Pre-programmed dynamic trading
- "Building block" state-contingent securities to create specialized payout patterns

- Expropriation efficient
- Regulatory efficient
- Liquidity tradeoff
- Transaction cost efficient

For illustrative purposes only.

Constructing the Optimal Combination of Risky Assets (OCRA)



Start with the market cap-weighted passive index for maximum diversification.

If CAPM does not hold, then it is possible to increase the Sharpe ratio over the passive benchmark; thus “alphas” from active management exist but they must be identified.

Three different sources of alpha:

- Market information inefficiency: traditional alpha
- Market frictions and institutional rigidities: financial-services alpha
- Other systematic risks in addition to market-portfolio beta: dimensional alpha

The passive and active components are combined to create OCRA.

Failure of CAPM Implies Alpha Exists for Market Portfolio Benchmark

Stages of production process for a specified investment goal

Possible reasons for CAPM failure:

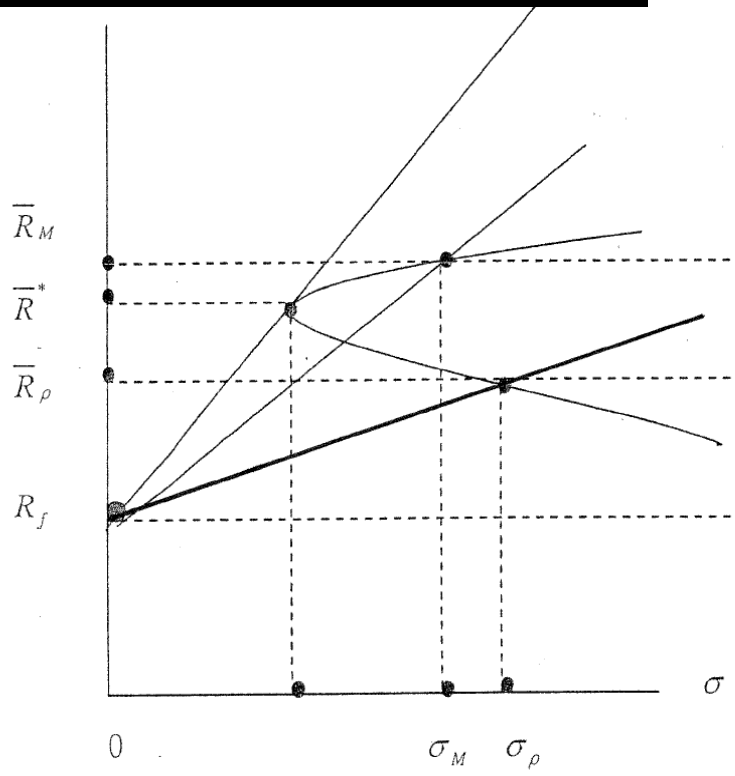
- Empirical Deviations from CAPM Black, Jensen and Scholes (1972); Fama and MacBeth (1973); Fama/French (1992)
- Market Information Inefficiency: Traditional Alpha
- Market Frictions: Affected by Technology, Institutions, and Regulation
  - Institutional rigidities from regulation or charter/prospectus restrictions/requirements
  - Taxes and accounting rules
  - Leverage inefficiency; borrowing constraints
  - Short-sale restrictions and cost
  - Stock loan limitation and tracking requirements
- Other Dimensions of Risk besides Market Beta
- Hedging roles for securities in addition to diversification
- Uncertainty about the future investment opportunity set; i.e., changing interest rates, volatility and Sharpe ratio risks
- Uncertainty about human capital labor income
- Uncertainty about inflation and the menu of possible consumption goods in the future
- Uncertainty about relative prices of consumption goods;
- Uncertainty about liquidity
- Uncertainty about mortality and longevity
- More-Complete Equilibrium Asset Pricing Models: Multiple Betas and Risk Dimensions with Risk Premiums

$$\overline{R}_j = R_f + \sum_{k=1}^{m} \beta_{jk}\left[\overline{E}_k - R_f\right]$$

- Where βjk is the (theoretical) multiple-regression coefficient from regressing the return on security j on the returns on the “m” dimension portfolios, “E1,...,Em”
- Intertemporal Capital Asset Pricing Model (Merton 1973,1975)
- Arbitrage-Pricing Theory Asset Pricing Model (Ross 1976)
- Consumption-based Capital Asset Pricing Model (Breeden 1979)
- Fama/French 3- or 4-Factor Model (reduced-form model)

Market Cap-Weighted Index Portfolio is Always an Important Component of the Optimal Combination of Risky Assets

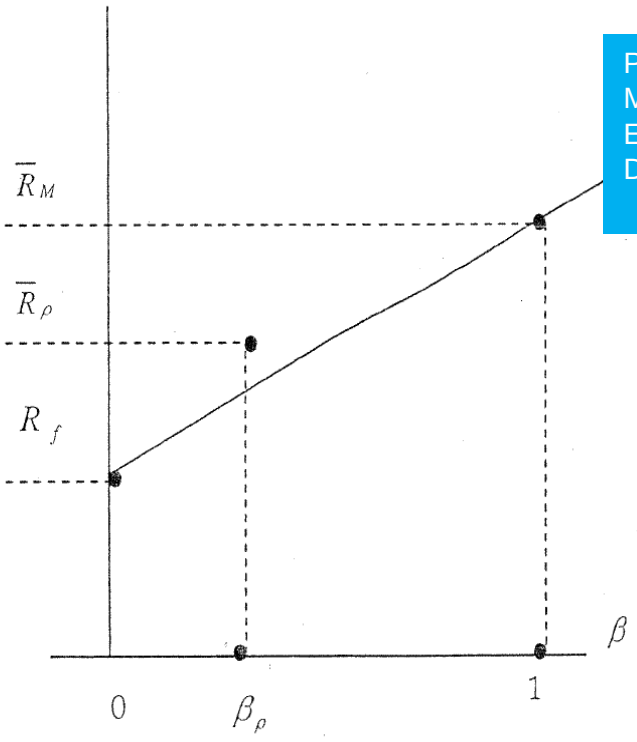
Total Portfolio Risk-Return



$$R = R_f + S\sigma$$

S = Sharpe Ratio

Portfolio Component Risk-Return



$$\overline{R}_\rho = R_f + \beta_\rho\left(\overline{R}_M - R_f\right) + \alpha_\rho$$

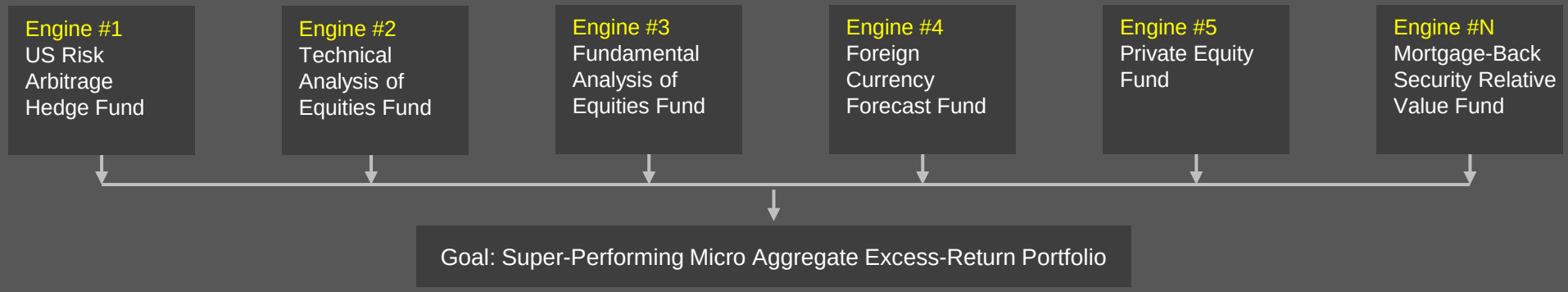
Passive Benchmark
Market Portfolio
Efficient
Diversification

Domain of Investment Management

Asset-Class Allocation example: Macro-Sector Market Timing “Long-Short” combinations to change fractional allocations from Benchmark Weights

Asset Class	Benchmark Weight	Long (Short) Incremental	Revised Weight
Small Cap Equity	5%	+5%	10%
Mid Cap Equity	10%	0%	10%
Large Cap Equity	30%	(10%)	20%
Emerging Market Equity	15%	(5%)	10%
Domestic Fixed-Income	30%	5%	35%
Real Estate	10%	5%	15%
	100%	0%	100%

Micro “Excess Return” Portfolio: Security Selection: “Alpha Engines”



For illustrative purposes only. There is no guarantee strategies will be successful.

Seeking Superior and Sustainable Investment Performance

Traditional alpha vs. financial-services alpha

Traditional alpha: market informational inefficiency

- Depends on being faster, smarter, better models or better information inputs
- Is it sustainable? Is it scalable?
- Kenneth French[1], "The Cost of Active Investing," *Journal of Finance* (August 2008) compares the fees, expenses, and trading costs society pays to invest in the US stock market with an estimate of what would be paid if everyone invested passively. Averaging over 1980 to 2006, finds that investors spend 0.67% of the aggregate value of the market each year searching for superior returns. Society's capitalized cost of price discovery is at least 10% of the current market cap. Under reasonable assumptions, the typical investor would increase his average annual return by 67 basis points over the 1980 to 2006 period if he switched to a passive market portfolio.
- Non-economic costs and benefits

Financial-services alpha: financial intermediation of institutional rigidities and market frictions

- Depends critically on being lightly regulated, with highly skilled professionals who can identify which rigidities are binding; diagnose which security prices are impacted by the rigidities; devise an efficient trading strategy to provide "the other side" of the trade to alleviate the impact of the rigidity on affected institutions; and earn an intermediation fee in the form of the excess return on the strategy. Other helpful but not essential advantages: strong credit-standing, long-horizon, flexible liquidity needs, large pool of assets, reputational capital, and sponsorship value.
- Is it sustainable? Is it scalable?
- Hedge funds with light regulation have a comparative advantage vs. regulated institutions in intermediating institutional rigidities, which defines their functional purpose in the financial "ecosystem."

1. Ken French is a member of the Board of Directors for and provide consulting services to Dimensional Fund Advisors LP.

Seeking Superior and Sustainable Investment Performance

Traditional alpha vs. dimensional alpha

- In the CAPM equilibrium, the market portfolio is the OCRA for mean-variance investors, and those investors hold the same risky portfolio of assets. However, in more complete equilibrium models, investors use securities to hedge other dimensions of risk in addition to the overall market risk. So in general, investors will not hold the same proportions of risky assets, and thus the market portfolio will not be mean-variance efficient [aka OCRA], and the CAPM will fail.
- The existence of alphas relative to the passive market benchmark is entirely consistent with perfect-market and efficient-market conditions, and these alphas are long-run sustainable because these are risks that, on balance, investors are willing to pay a risk premium to avoid.
- While theoretical structural models suggest the potential identity of these other dimensions of risk, the search for these dimensions with alphas has been largely empirical, resulting in reduced-form models with surrogate dimensions and factors, rather than the actual structural ones. Well-known examples of factors that appear to have significant alphas over long time periods and across geopolitical borders are size of company [small – large], ratio of book-to-market value [high – low], ratio of profits-to-market value, and possibly liquidity [low – high].
- Alphas from identified dimensions of risk with risk premiums are called “dimensional alphas.”

The Search for Dimensional Alpha

Empirical dimensions of risks with risk premiums

- Fama/French[1] (1992): Market, Size, and Value
- Other: Profitability, Momentum, and Illiquidity

Conditions for evaluation of candidates for a dimension of risk with a risk premium

- ***Apriori*** reasoning supported by financial economic theory, consistent with information-efficient market
- Persistent: statistically significant risk premium over very long history [~50+ years]
- Pervasive: statistically significant risk premium across geopolitical borders
- Continuous: the risk premium observed in proportion to exposure to the dimension, across all securities
- Robust: possible to identify exposure to dimension that is not sensitive to precise parameter estimates
- Implementation: exposure to the dimension implemented in a scalable, cost-effective, and reliable fashion

1. Eugene Fama and Ken French are members of the Board of Directors for and provide consulting services to Dimensional Fund Advisors LP.

Hedge Funds: A Case Study on Alpha-Source Performance Attribution

Relation between hedge fund returns and corporate bond illiquidity risk factor 1994–2010

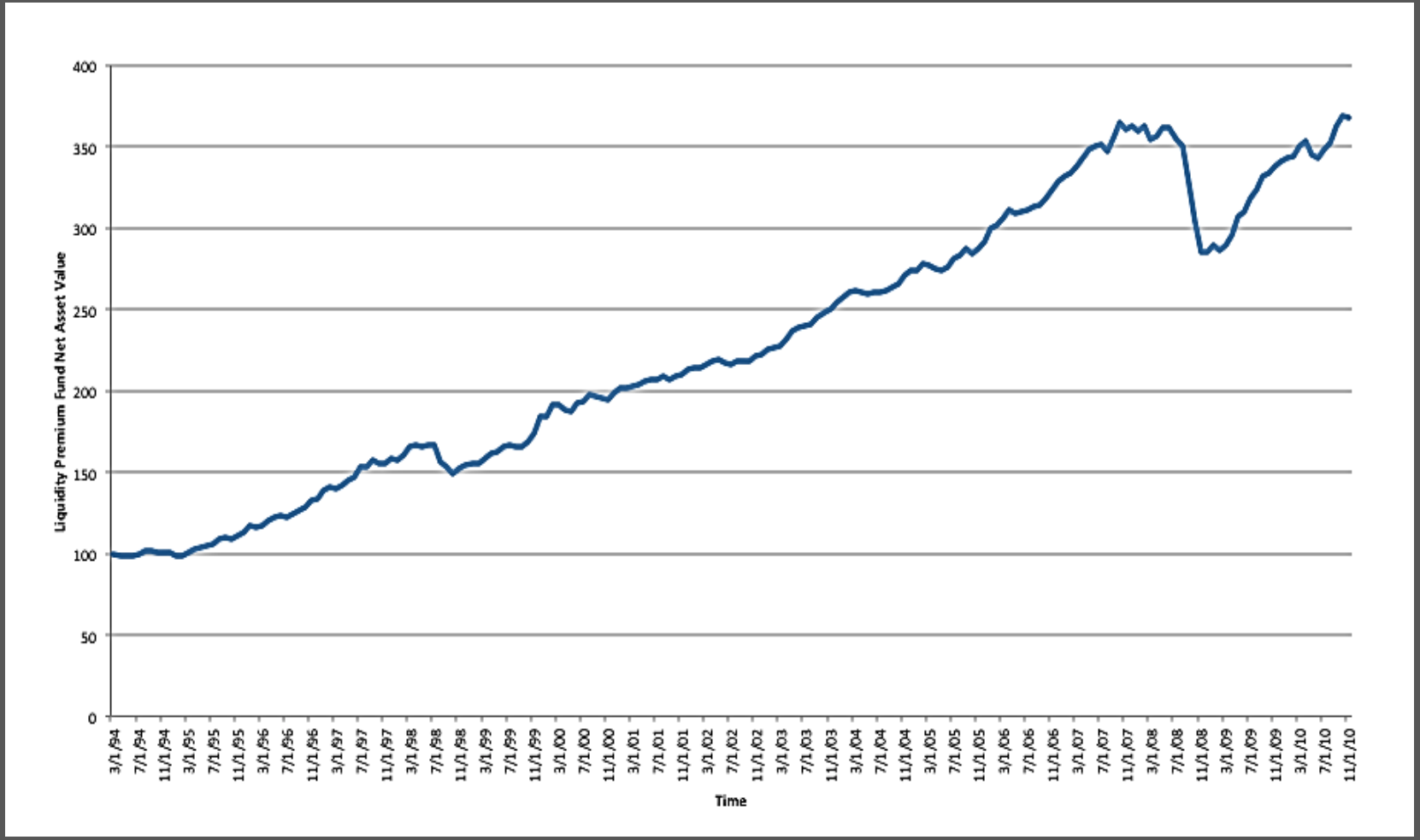
Performance attribution among traditional alpha, financial-services alpha, and dimensional alpha

Strategy	Alpha w/o factor	t-stat Alpha	Alpha with factor	t-stat Alpha
Convertible Arbitrage	7.23%	2.82	3.07%	1.58
Dedicated Short	-1.27%	0.84	-1.48%	0.98
Emerging Markets	12.48%	4.25	5.23%	2.21
Equity Market Neutral	6.07%	4.11	1.65%	1.44
Event Driven	8.65%	2.74	6.38%	1.61
Fixed Income Arbitrage	9.47%	3.27	4.33%	2.07
Global Macro	10.98%	3.63	3.29%	1.08
Long/Short Equity	10.07%	3.06	4.53%	0.78
Managed Futures	4.10%	1.54	3.82%	1.82
Multi-Strategy	7.39%	2.28	3.09%	1.53

References: Chacko, G., S. Das, and R. Fang (2012): "An Index-Based Measure of Liquidity," Working Paper, Santa Clara University.
Chacko, G., C.L. Evans (2012): "Liquidity Risk in Corporate Bond Markets," Working Paper, Santa Clara University.
Past performance is no guarantee of future results.

Cumulative Returns Corp Bond Illiquidity Risk Portfolio

1994–2010 Evidence in support for financial-service alpha source



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Decomposition of the Sources of Alpha: Summary

Investment management process

- Only three primary ways to manage risk: diversification, hedging, and insuring
- Market portfolio: foundation component of the optimal combination of risky assets (OCRA)
- Failure of the CAPM implies alpha exists relative to the passive market portfolio benchmark

Benefits of decomposition of the sources of alpha: seeking to create superior performance over the market portfolio

- Improved asset manager performance evaluation and assessment of potential future performance
- Improved asset allocation among alpha-generating investments within the total portfolio from better estimates of the correlations among alpha-generating investment returns
- More temporally stable organization of the active management activities along alpha source lines vs. asset class or style lines.

Traditional alpha vs. financial-services alpha: performance and sustainability

- Functions served by financial institutions as part of the financial ecosystem

Traditional alpha vs. dimensional alpha: performance and sustainability

- The search for dimensional alpha

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Profile: Robert C. Merton

Robert C. Merton is the School of Management Distinguished Professor of Finance at the MIT Sloan School of Management and University Professor Emeritus at Harvard University. He was the George Fisher Baker Professor of Business Administration (1988–98) and the John and Natty McArthur University Professor (1998–2010) at Harvard Business School. After receiving a Ph.D. in Economics from MIT in 1970, Merton served on the finance faculty of MIT's Sloan School of Management until 1988 at which time he was J.C. Penney Professor of Management. He is currently Resident Scientist at Dimensional Holdings, Inc., where he is the creator of Target Retirement Solution, a global integrated retirement-funding solution system

Merton received the Alfred Nobel Memorial Prize in Economic Sciences in 1997 for a new method to determine the value of derivatives. He is past president of the American Finance Association, a member of the National Academy of Sciences, and a Fellow of the American Academy of Arts and Sciences.

Merton has also been recognized for translating finance science into practice. He received the inaugural Financial Engineer of the Year Award from the International Association for Quantitative Finance (formerly International Association of Financial Engineers), which also elected him a Senior Fellow. He received the 2011 CME Group Melamed-Arditti Innovation Award, and the 2013 WFE Award for Excellence from World Federation of Exchanges. A Distinguished Fellow of the Institute for Quantitative Research in Finance ('Q Group') and a Fellow of the Financial Management Association, Merton received the Nicholas Molodovsky Award from the CFA Institute. He is a member of the Halls of Fame of the Fixed Income Analyst Society, Risk, and Derivative Strategy magazines. Merton received Risk’s Lifetime Achievement Award for contributions to the field of risk management.

Merton’s research focuses on finance theory, including lifecycle and retirement finance, optimal portfolio selection, capital asset pricing, pricing of derivative securities, credit risk, loan guarantees, financial innovation, the dynamics of institutional change, and improving the methods of measuring and managing macro-financial risk.

Merton received a B.S. in Engineering Mathematics from Columbia University, a M.S. in Applied Mathematics from California Institute of Technology and a Ph.D. in Economics from Massachusetts Institute of Technology and honorary degrees from thirteen universities.