UBS
Global Asset Management

Asset Allocation for Alternative Investments

QWAFAFEW

Renato Staub, May 16, 2003

Alternative Investments: Questions

- How do we approach alternatives in our investment framework?
- What is a recommended allocation to alternative investments?
- What is the composition of the alternative investments “portfolio”?

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The Plan

- Defining alternative investments
  - Assets vs. strategies
- Historical perspective on risk and return
- Forward-looking risk and return characteristics
  - Consistency with traditional asset classes
  - Systematic compensation and illiquidity
- Constructing a policy portfolio
  - Optimization vs. simulation

Alternative Assets: Definition

Suitability criteria

- **Analytical**
  - **Estimatable intrinsic value**
  - **Adequate marketability and liquidity**
  - **Meaningful impact**
  - **Manageable estimation risk**
- **Adequate control and regulation**
- **Legal**
- **Talent availability**
- **Identifiable passive risk and return characteristics – passive market**

Alternative Assets: Distinction

- **Uniqueness Criteria**
  - **Analytical similarity**
  - **Similar investment structure**
  - **Similar passive risk and return characteristics - passive market**
- **Based on these suitability and uniqueness criteria, alternative assets include the private markets, natural resources and real estate asset classes as well as the subclasses shown in the following table:**

Private Markets	Natural Resources	Real Estate
Early stage venture capital Late stage venture capital Leveraged buy-outs Mezzanine Distressed debt	Timberland Farmland Oil & gas	Apartments Industrial Office Retail

Alternative Strategies

- Distressed
- Event-Driven
- Fund of Funds
- Emerging
- Growth
- Value
- Macro
- Long/Short
- Risk-Arbitrage
- Convertible Arbitrage
- Fixed-Income Arbitrage
- Income
- Sector Technology
- Short Sellers

Sources: Brown, Goetzmann & Ibbotson; Philipp Cottier; HedgeFund.net; Managed Accounts Report; Van Hedge

Alternative Assets: Historical Data

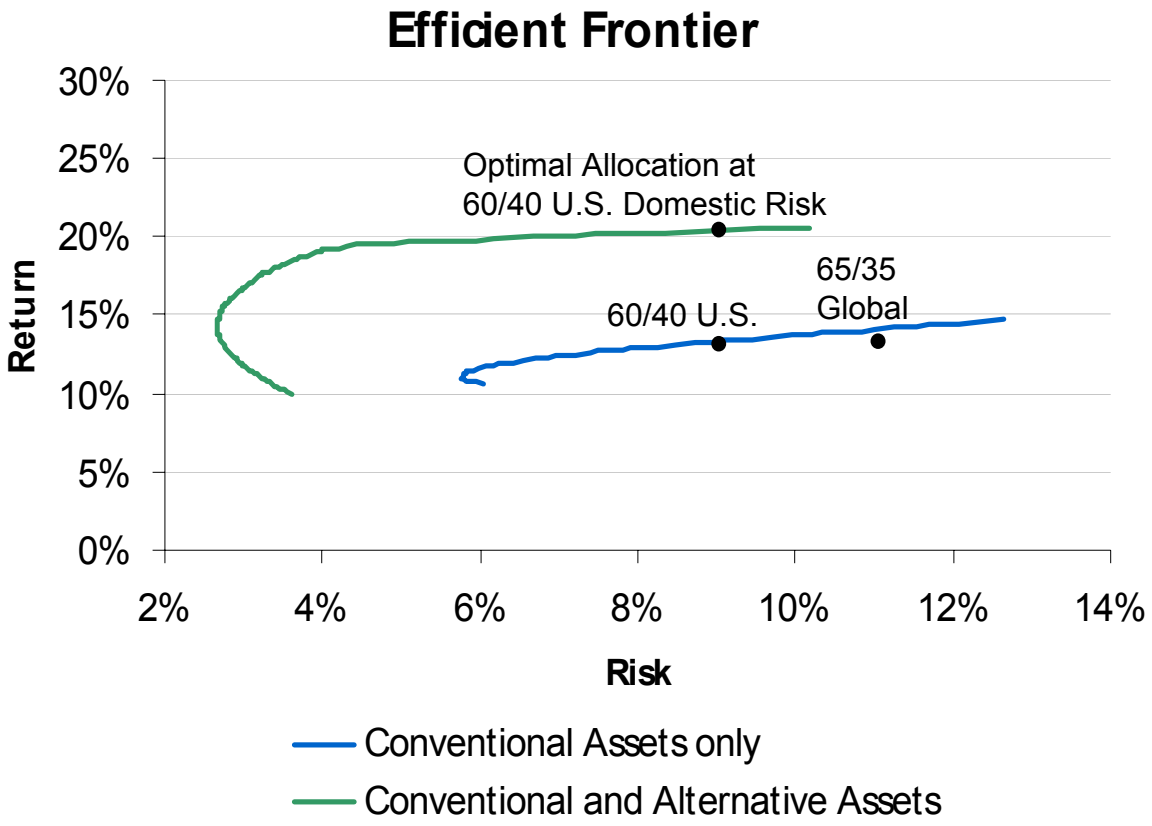
Traditional and Alternative Investments Historical Return, Volatility and Correlation Characteristics*

		Return	Volatility	1	2	3	4	5	6	7	8
1	US Equity	14.8%	12.8%	1.00	0.55	0.35	0.24	-0.46	-0.01	0.33	0.71
2	Ex-US Equity	13.2	16.7	0.55	1.00	0.14	0.29	0.00	0.39	0.25	0.52
3	US Fixed Income	10.5	7.0	0.35	0.14	1.00	0.73	-0.47	-0.05	0.17	0.31
4	Ex-US Fixed Income	10.7	6.0	0.24	0.29	0.73	1.00	-0.10	0.23	-0.08	0.14
5	Private Equity	20.7	10.5	-0.46	0.00	-0.47	-0.10	1.00	0.47	-0.53	-0.30
6	Real Estate	7.8	5.9	-0.01	0.39	-0.05	0.23	0.47	1.00	-0.51	-0.18
7	Natural Resources	18.3	8.8	0.33	0.25	0.17	-0.08	-0.53	-0.51	1.00	0.23
8	Hedge Funds	18.2	9.4	0.71	0.52	0.31	0.14	-0.30	-0.18	0.23	1.00

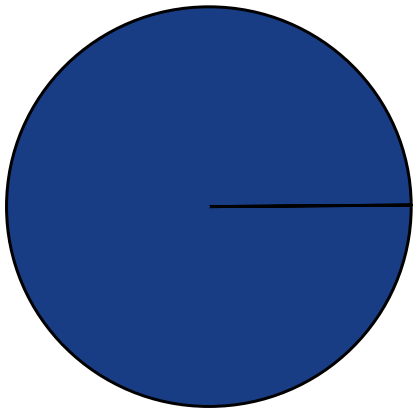
*Based on annual logarithmic excess returns from 1981-2000 (Natural Resources from 1987-2000). Sources: Wilshire, MSCI, Salomon, NCREIF, Venture Economics, Ibbotson Associates, Adams Street Partners, Brinson Partners. Hedge fu data are available from www.hedgefund.net.

Efficient Frontier and Optimized Portfolio

Based on Annual Data, 1981-2000



Optimal Allocation at 60/40 Risk Level



Alternative Investments 100%

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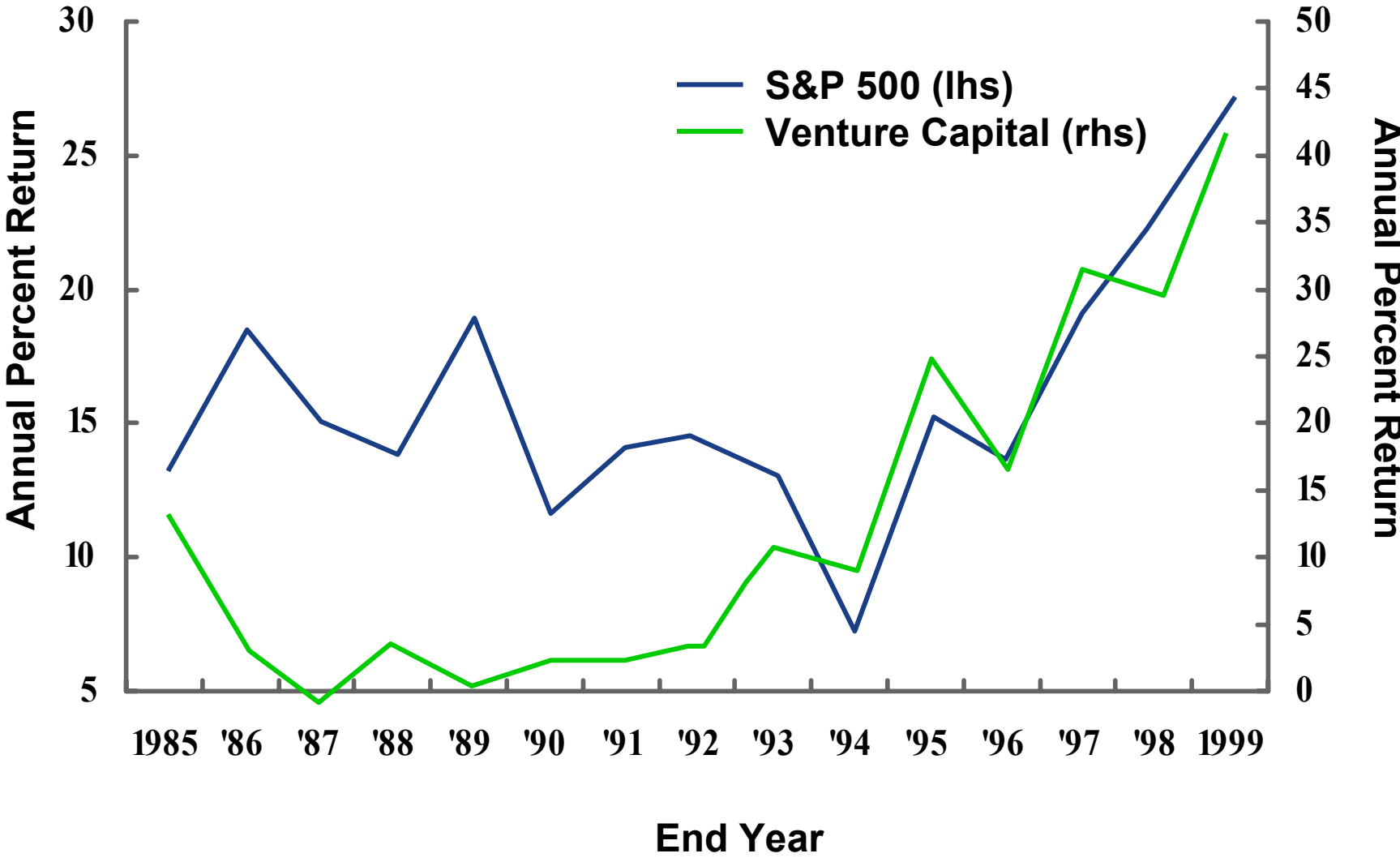
Problems with Historical Data

- Alternative investments often are not liquid
- Some alternatives, such as real estate, have appraisal-based pricing
- Prices and returns of others, such as venture capital, may only be observed upon liquidation of investment

Venture Capital and Equity: A Simple Comparison

Internal Rates of Return for 5-Year Holding Periods



Sources: Venture Economics, Standard & Poor's

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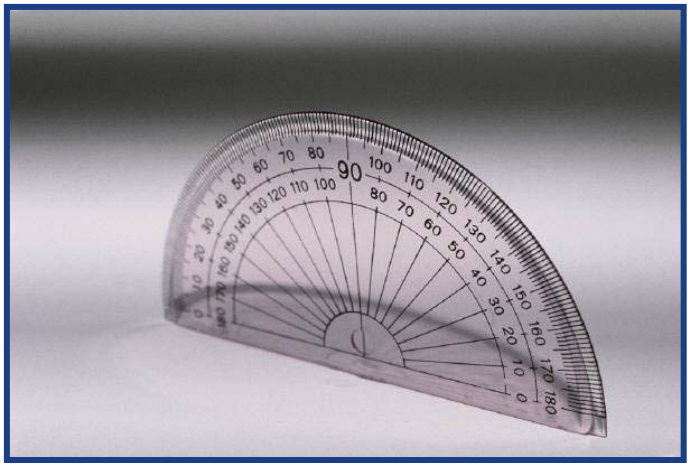
Rationale for Our Approach

- "Not being traded" does not mean "not changing in value"
- We want to reflect the fundamental underlying risk characteristics of all assets
- The covariance matrix should be mathematically consistent



The Approach: Covariance Matrix

There are 3 input matrices:

F: Factor-Covariance Matrix

L: Factor-Loadings Matrix

R: Residual Volatility Matrix

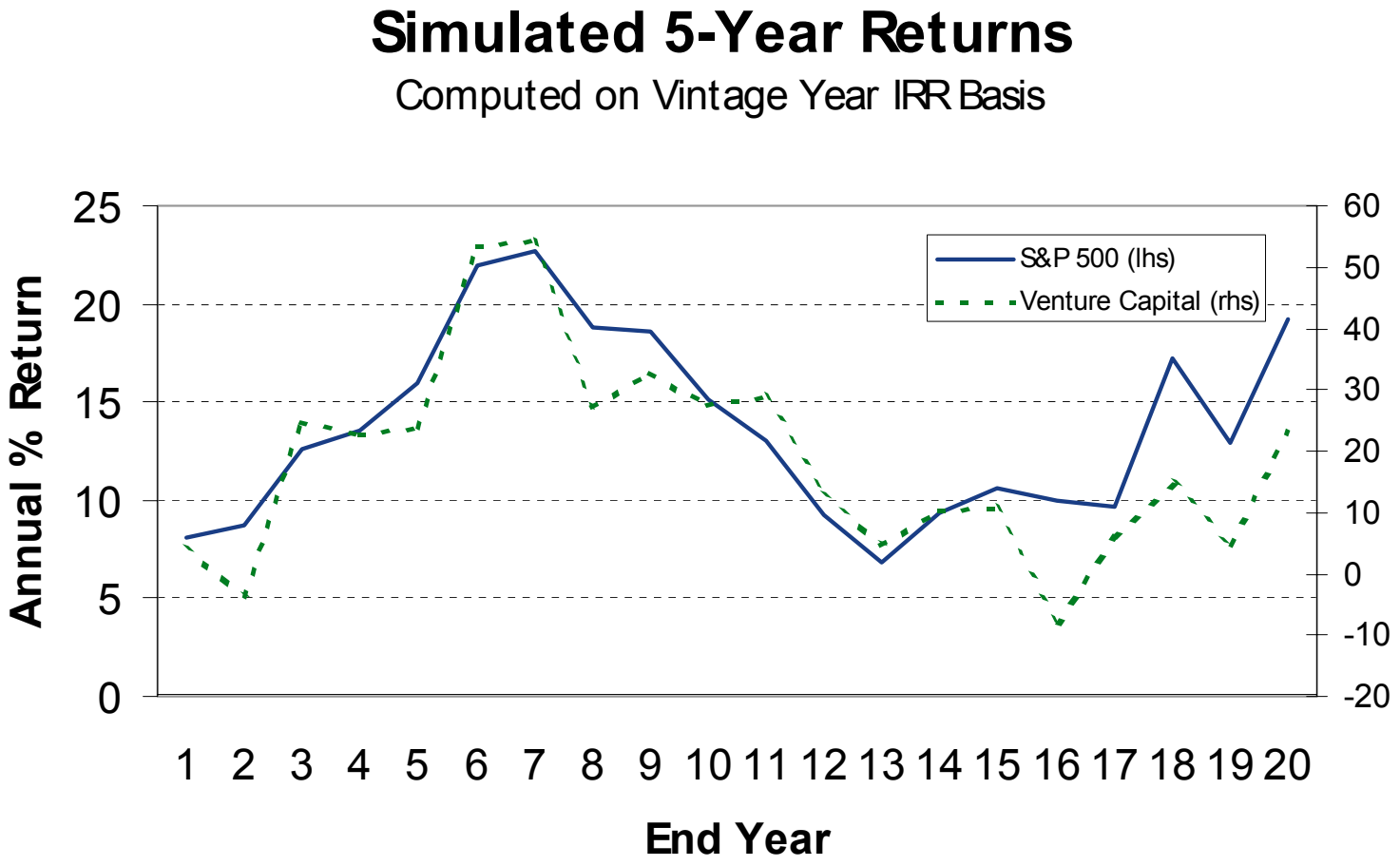
The Covariance Matrix is: $V = L^* F^* L' + R^2$

		Risk	1	2	3	4	5	6	7	8
1	US Equity	15.8	1.00							
2	Ex-US Equity	14.3	0.71	1.00						
3	US Bond	4.6	0.30	0.22	1.00					
4	Ex-US Bond	4.0	0.25	0.28	0.67	1.00				
5	Real Estate	10.0	0.38	0.28	0.19	0.15	1.00			
6	Private Equity	31.1	0.91	0.62	0.25	0.21	0.35	1.00		
7	Hedge Funds	6.9	0.58	0.42	0.19	0.16	0.23	0.59	1.00	
8	Natural Resources	14.0	0.35	0.25	0.10	0.09	0.14	0.32	0.21	1.00

Note: Ex-U.S. asset classes are hedged

Venture Capital and Equity: A Simple Comparison

Internal Rates of Return for 5-Year Holding Periods



Sources: Venture Economics, Standard & Poor's

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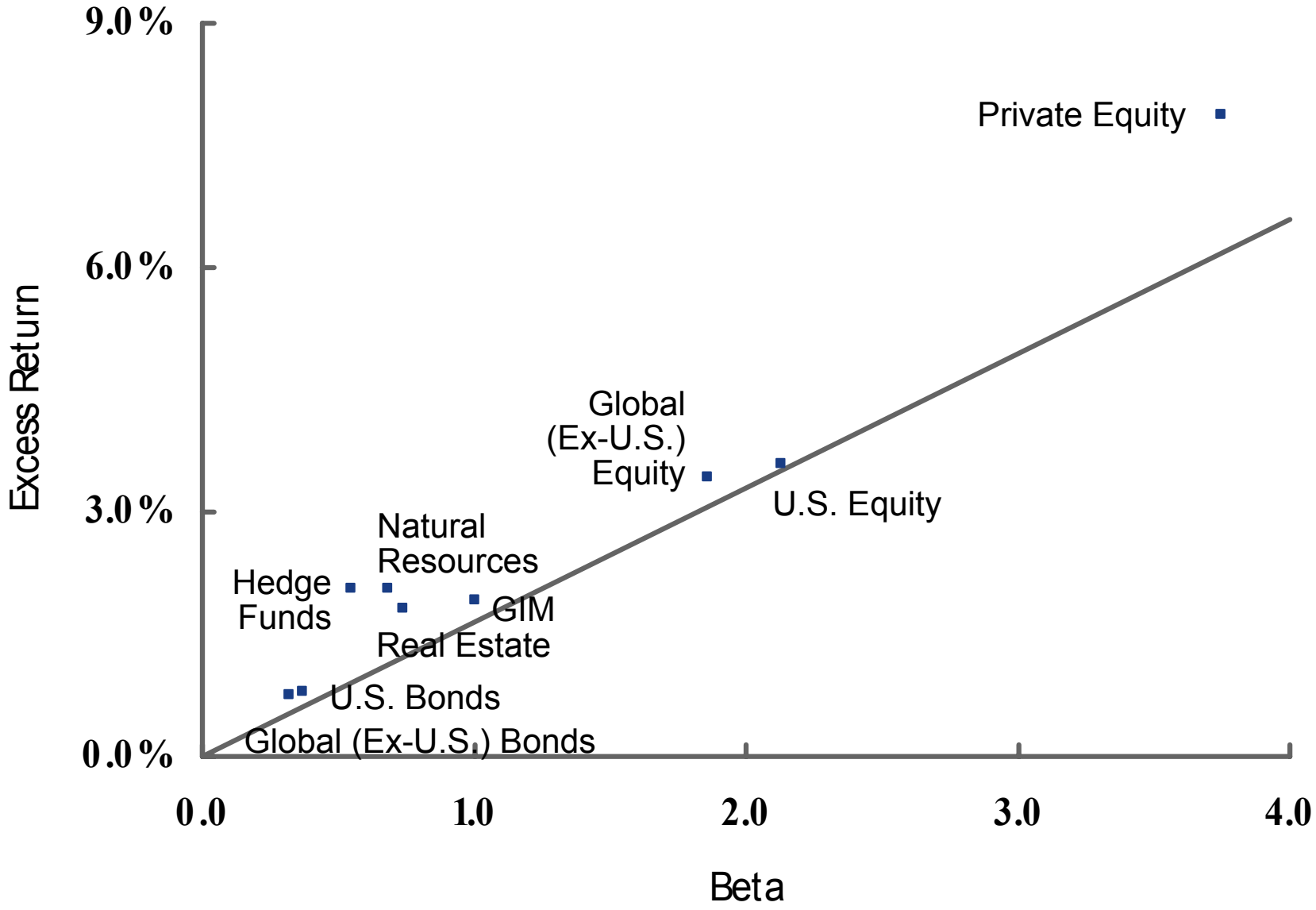
Required Returns

- Compensation for systematic risk
- Segmentation
- Liquidity risk, time horizon and rebalancing

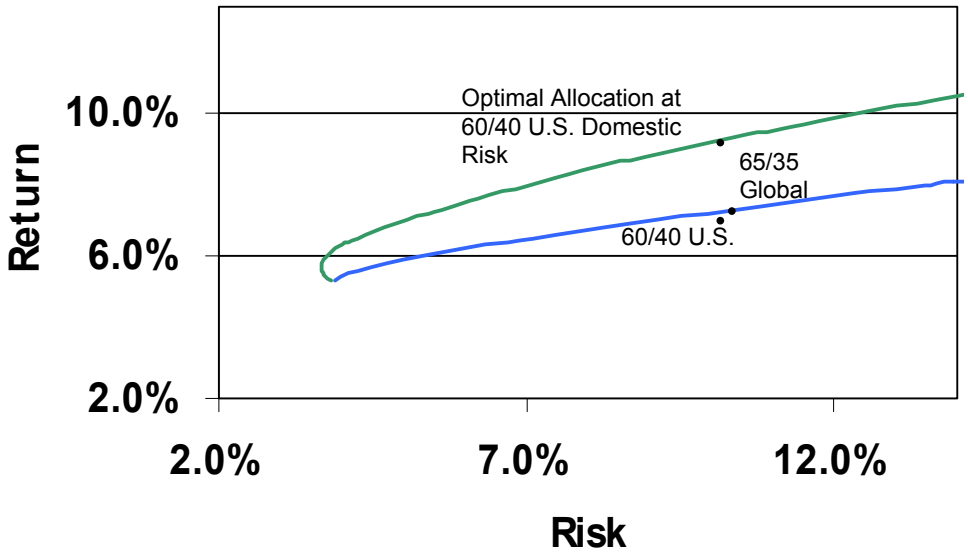
Equilibrium Risk and Return



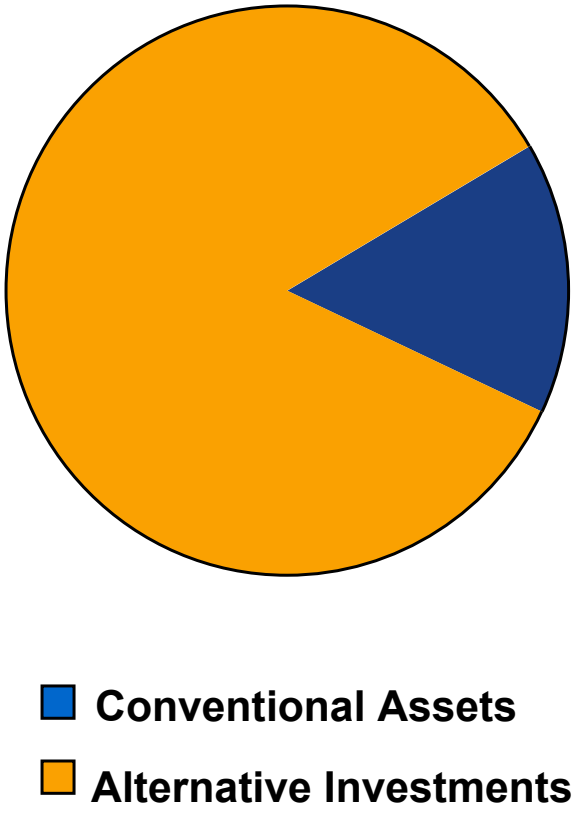
Efficient Frontier and Optimized Portfolio

Based on Equilibrium Data

Efficient Frontier



Optimal Allocation at 60/40 Risk Level



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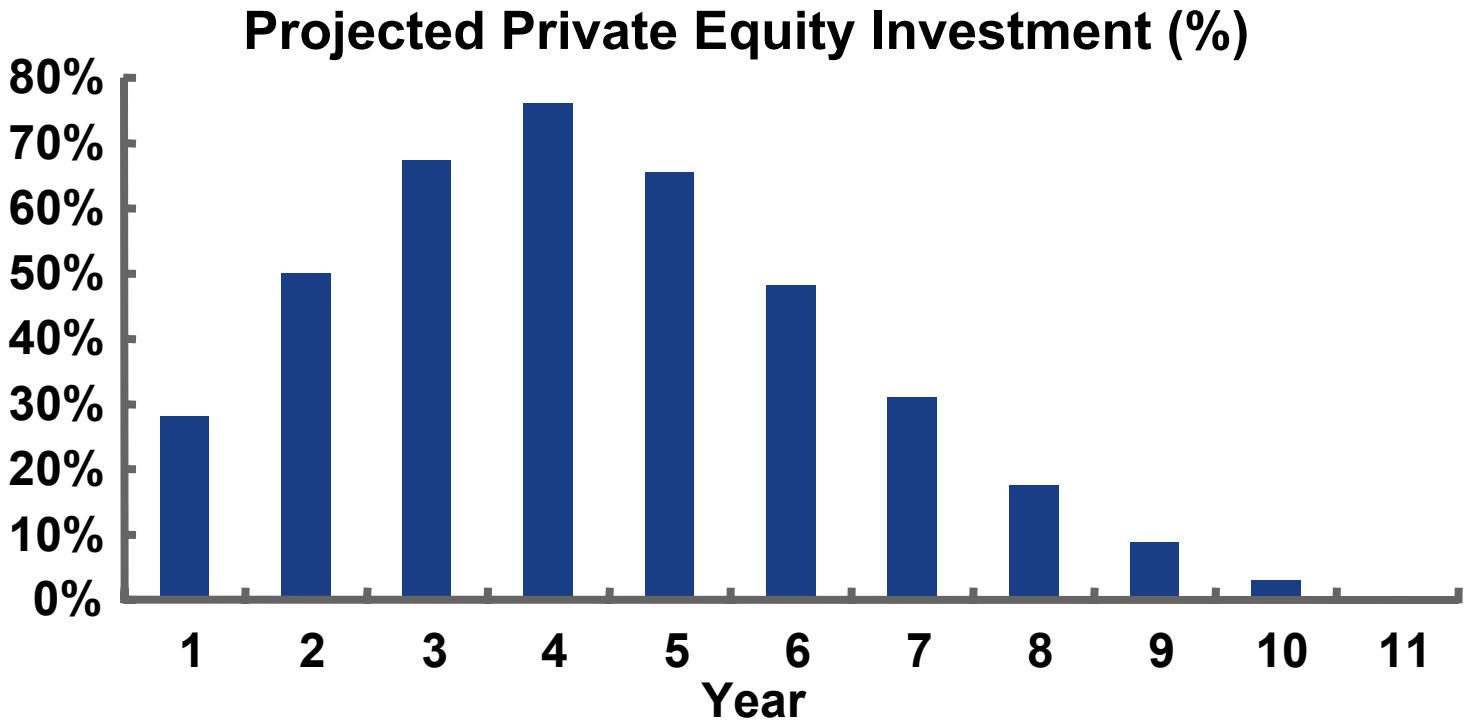
Optimization vs. Simulation

- **Optimization**
  - Assumes single period or rebalancing ability
  - Fails to capture illiquidity
- Simulations allow realistic modeling of liquidity
  - Some alternatives can be rebalanced with a lag
  - Others can only be moved toward target over multiple periods



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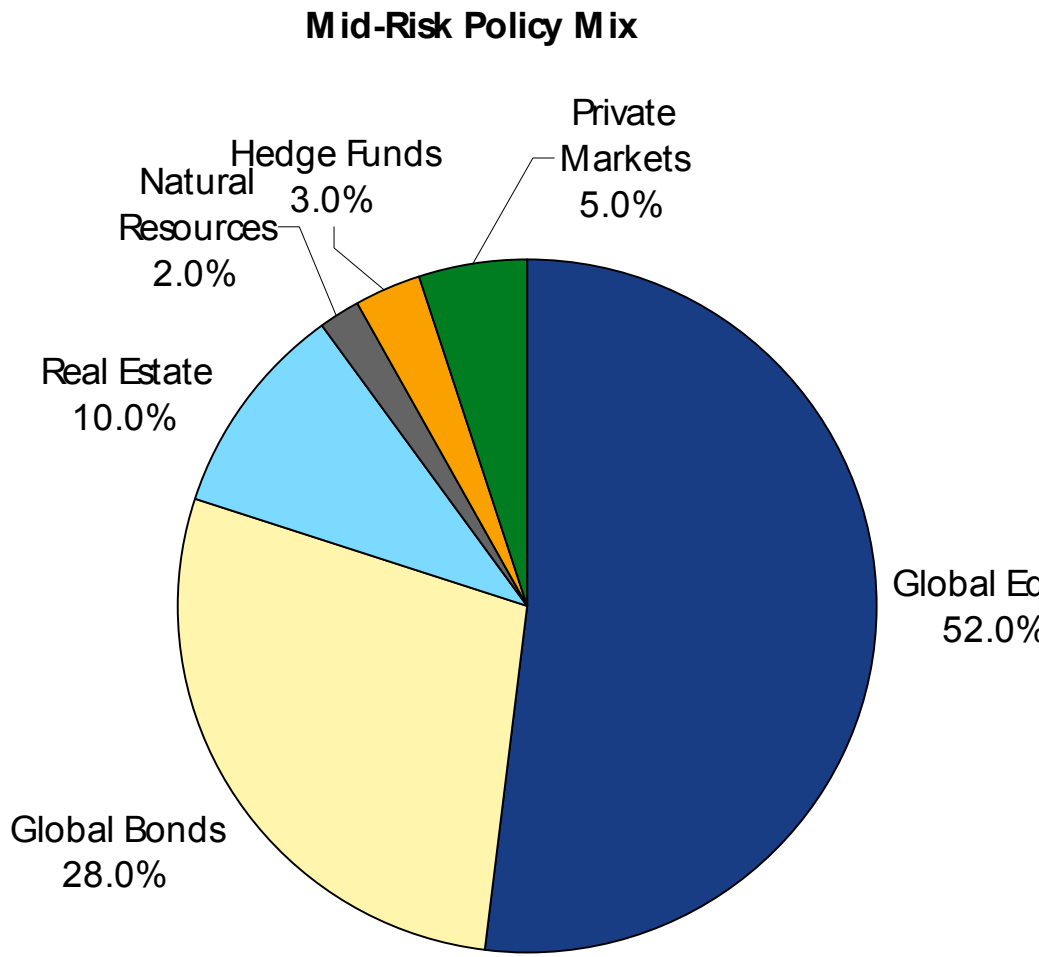
Simulation and the Policy Portfolio

- The objective: Policy for a middle-risk institutional investor with moderate liquidity needs
- Two key parameters:
  - Tolerance for changes in portfolio risk and allocations
  - Tolerance for illiquidity
- Instead of optimizing, we simulate various policy portfolios and examine their characteristics

Policy Portfolio

- **The simulations provide general guidelines for allocations**
- **Target allocation to alternative investments: 20%**



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Policy Portfolio Characteristics

- Favorable risk and return characteristics compared to global balanced portfolio
  - Return is improved: 7.7% vs. 7.2%
  - Risk is about the same: 10.1% vs. 10.3%

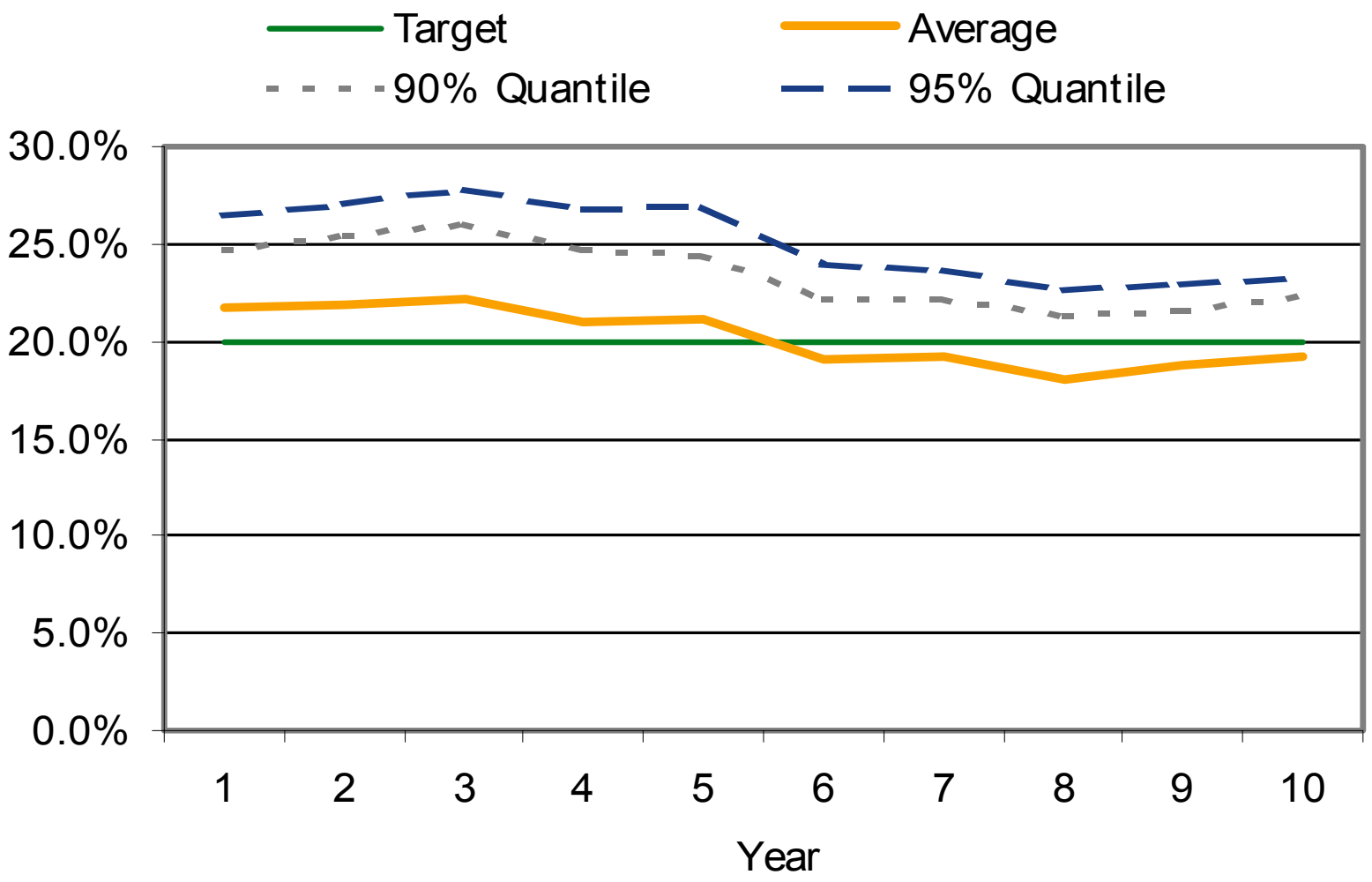
- The portfolio has an Illiquidity Quotient of 24%
  - Illiquidity Quotient = illiquid assets as a share of total assets
  - Illiquid assets = Alternative Investments
    Emerging Markets
    High Yield
  - Varying degrees of illiquidity

Simulation Results: Policy Portfolio

- **Private equity allocation**
  - Although the target is 5%, illiquidity means allocation drifts substantially
  - Actual allocation is greater than 14% in 5% of the simulated periods
- **Alternative investments allocation**
  - With target of 20%, alternatives exceed 28% of portfolio 5% of time
  - Source of drift is inability to rebalance instantaneously
- **Portfolio risk**
  - Ex ante risk of portfolio at policy weights is 10.1%
  - Due to alternatives drift, ex ante portfolio risk is above 11.5% in 5% of periods

Policy Portfolio: Simulations

Alternative Allocation (%)



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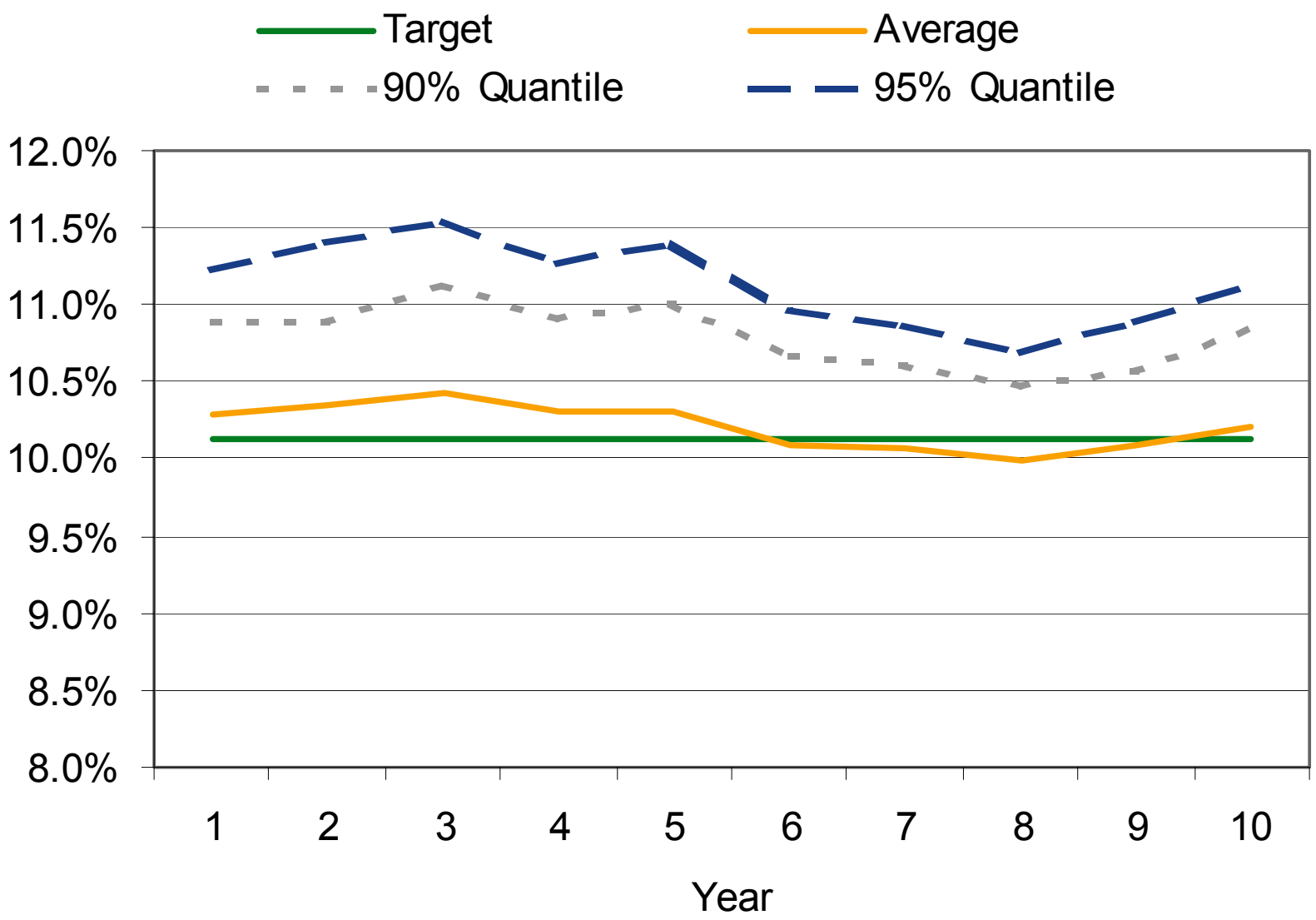
Policy Portfolio: Simulations (Continued)

Portfolio Volatility (%)



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Conclusions

- The framework
  - Treatment of alternative investments consistent with conventional assets
  - Intuitive setting of risk characteristics for alternatives
  - Simulation of policy portfolio, including alternative investments, captures more realistic environment
- The results
  - Portfolio with alternatives has favorable risk-return characteristics due to enhanced diversification and compensation
  - However, if there is no free lunch, investors are compensated for assuming illiquidity

Appendix

Alternative Strategies: Definition

	BGI	Cottier	HFN
Distressed	Event-Driven	Distressed Securities	Distressed
Event-Driven			Event-Driven
Fund of Funds	Fund of Funds	Multi-Manager Hedge Funds	Fund of Funds
Emerging		Emerging Market Equity and Debt Funds	Emerging
Growth	U.S. Opportunity	Leveraged Long Equity Hedge Funds	Aggressive Growth
Value			Value
Macro		Macro Hedge Funds	Macro
Long/Short	Market Neutral	Long/Short U.S. Equity Hedge Fund	Long/Short
Risk-Arbitrage		Distressed Securities	Risk-Arbitrage
Convertible Arbitrage		Convertible Bond Hedge Fund	Convertible Arbitrage
Fixed-Income Arbitrage		Leveraged Bond and Fixed Income Arbitrage Hedge Fund	Fixed-Income Arbitrage
Income			Fixed Income
Sector Technology	Sector		Technology Sector
Short Sellers	Short Sellers	Short-only Equity Hedge Funds	Short Bias

Sources: BGI: Brown, Goetzmann & Ibbotson; Cottier: Philipp Cottier; HFN: HedgeFund.net

Alternative Strategies: Definition

	Cottier	HFN
Distressed	Distressed Securities	Distressed Securities
Event-Driven		Special Situations
Fund of Funds	Fund of Funds	Fund of Funds
Emerging	Regional Emerging	Emerging Markets
Growth	Global Growth	Aggressive Growth
Value	Global Value	Value
Macro	Global Macro	Macro
Long/Short	Long/Short	Market Neutral - Securities Hedging
Risk-Arbitrage	Risk-Arbitrage	Market Neutral - Risk Arbitrage
Convertible Arbitrage	Arbitrage	
Fixed-Income Arbitrage		
Income		Income
Sector Technology	Sector Technology	Technology
Short Sellers	Short-Sellers	Short Selling

Sources: MAR: Managed Accounts Report; Van Hedge

Assuring Consistency of Risk Matrix

Create a "small" forward-looking covariance matrix consisting of a set of primary factors or characteristics

			Correlations										
		Risk	1	2	3	4	5	6	7	8	9	10	11	12
1	Real Estate	8.8	1.00	0.28	0.41	0.25	0.20	0.22	0.22	0.16	0.11	0.00	0.00	0.00
2	US Growth	22.0	0.28	1.00	0.70	0.30	0.25	0.28	0.15	0.13	0.08	0.00	0.00	0.00
3	US Equity	15.0	0.41	0.70	1.00	0.60	0.50	0.55	0.30	0.25	0.15	0.00	0.00	0.00
4	European Equity	16.5	0.25	0.30	0.60	1.00	0.50	0.50	0.20	0.30	0.10	0.00	0.00	0.00
5	Japanese Equity	20.0	0.20	0.25	0.50	0.50	1.00	0.45	0.15	0.15	0.30	0.00	0.00	0.00
6	Asian Equity	29.0	0.22	0.28	0.55	0.50	0.45	1.00	0.10	0.10	0.10	0.00	0.00	0.00
7	US Bonds	5.1	0.22	0.15	0.30	0.20	0.15	0.10	1.00	0.60	0.50	0.00	0.00	0.00
8	EMU Bonds	4.4	0.16	0.13	0.25	0.30	0.15	0.10	0.60	1.00	0.50	0.00	0.00	0.00
9	Japanese Bonds	4.8	0.11	0.08	0.15	0.10	0.30	0.10	0.50	0.50	1.00	0.00	0.00	0.00
10	EMU/USD	11.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.50	0.10
11	JPY/USD	11.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	1.00	0.15
12	AUD/USD	10.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.15	1.00

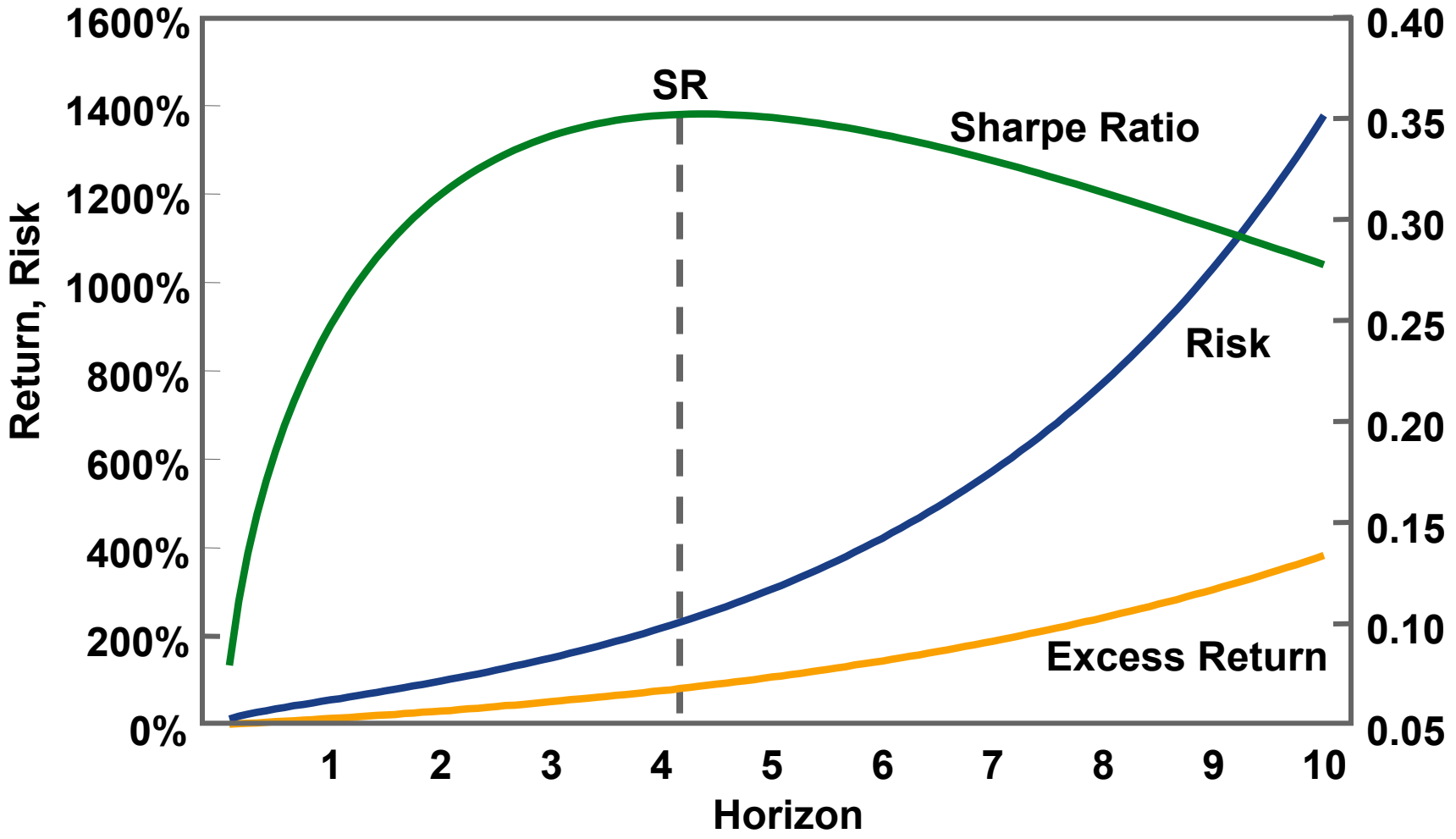
Assuring Consistency of Risk Matrix (Continued)

- Set sensitivities of individual markets or assets to each of the factors
- Assign each market or asset its own specific risk

Asset	US Equity Loading	US Fixed Income Loading	Specific Risk	Total Risk
Early Stage Venture Capital	160%	110%	26.0%	44.8%
Late Stage Venture Capital	135	90	17.0	35.1
Mezzanine	60	70	14.5	18.0
LBOs	230	-70	14.5	36.6
Distressed	70	90	16.0	20.4
Real Estate – Office	26	21	10.3	11.2
Real Estate – Industrial	24	16	9.7	10.4
Real Estate – Retail	25	14	10.3	11.1
Real Estate – Apartment	22	9	9.7	10.2
Natural Resources	33	0	13.1	14.0
Hedge Funds	23	6	5.7	6.9

Risk Premia: Approach 1

Holding Period: Excess Return, Risk, and Sharpe Ratio



Note: all Holding Period estimates are cumulative rather than annualized values

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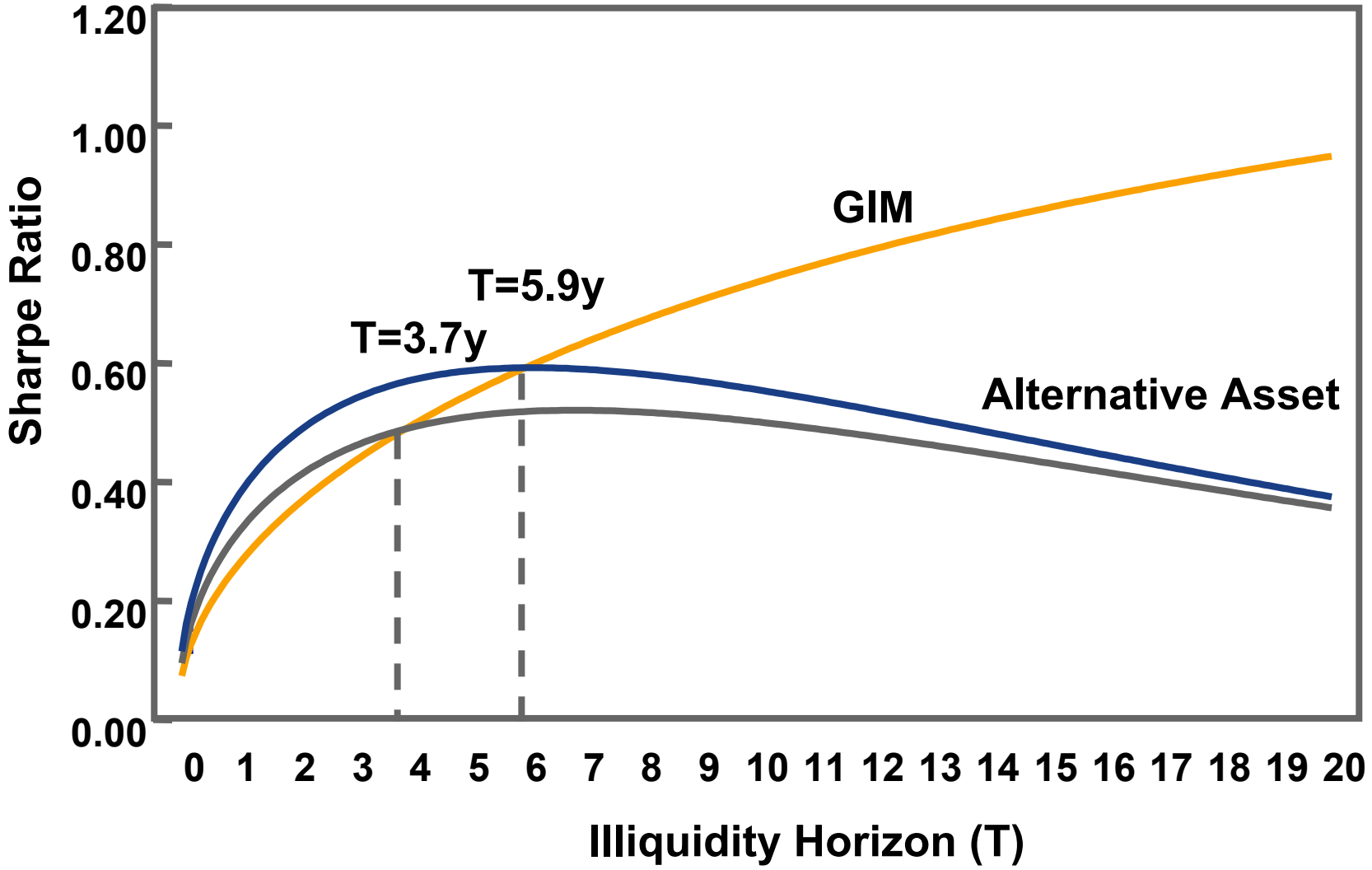
Risk Premia: Approach 1

Holding Period Sharpe Ratio



Note: all Holding Period estimates are cumulative rather than annualized values

Asset Allocation – First Case Study

- **The client's actual policy is allocation #1**

	Allocation						
	1	2	3	4	5	6	7
U.S. Equity	47.0%	45.0%	43.0%	41.0%	39.0%	37.1%	34.8%
ex-U.S. Equity	17.0%	17.0%	17.0%	17.0%	17.0%	16.2%	15.2%
Emering Equity	3.0%	3.0%	3.0%	3.0%	3.0%	2.9%	2.7%
U.S. Bonds	25.0%	25.0%	25.0%	25.0%	25.0%	23.8%	22.3%
Liquid Assets	92.0%	90.0%	88.0%	86.0%	84.0%	80.0%	75.0%
REITS	5.0%	5.0%	5.0%	5.0%	5.0%	6.3%	7.8%
Real Estate					2.0%	2.5%	3.1%
Venture Late Stage	3.0%	3.0%	3.0%	3.0%	3.0%	3.8%	4.7%
LBO		2.0%	2.0%	2.0%	2.0%	2.5%	3.1%
Mezzanine			1.0%	1.0%	1.0%	1.3%	1.6%
Distressed Debt			1.0%	1.0%	1.0%	1.3%	1.6%
Timber				2.0%	2.0%	2.5%	3.1%
Alternative Assets	8.0%	10.0%	12.0%	14.0%	16.0%	20.0%	25.0%
Target Risk	11.1%	11.4%	11.3%	11.1%	10.9%	11.0%	11.1%
95% Mark *)	12.1%	13.1%	12.1%	11.9%	11.8%	12.1%	12.5%
Difference	1.0%	1.7%	0.8%	0.9%	0.9%	1.1%	1.5%
Target Allocation	8.0%	10.0%	12.0%	14.0%	16.0%	20.0%	25.0%
95% Mark *)	17.4%	21.4%	20.4%	21.6%	25.1%	30.3%	36.9%
Difference	9.4%	11.4%	8.4%	7.6%	9.1%	10.3%	11.9%
Equilibrium Return	7.67%	7.80%	7.83%	7.84%	7.83%	7.96%	8.12%
Sharpe Ratio (GIM: 0.28)	**0.291**	**0.294**	**0.299**	**0.306**	**0.311**	**0.321**	**0.332**

- **Overall the Sharpe Ratio is improved**
- **However, beyond a certain point, this is at the cost of bigger risk swings**

Asset Allocation – Second Case Study

- **The client's actual policy is allocation #1**

	Allocation					
	1	2	3	4	5	6
U.S. Equity	36.0%	36.0%	36.0%	36.0%	34.3%	32.1%
ex-U.S. Equity	15.0%	15.0%	15.0%	15.0%	14.3%	13.4%
Emering Equity	3.0%	3.0%	3.0%	3.0%	2.9%	2.7%
U.S. Bonds	20.0%	20.0%	20.0%	20.0%	19.0%	17.8%
Emerging Bonds	3.0%	3.0%	3.0%	3.0%	2.9%	2.7%
Other Bonds	6.0%	6.0%	6.0%	6.0%	5.7%	5.3%
Cash	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Liquid Assets	84.0%	84.0%	84.0%	84.0%	80.0%	75.0%
Venture Early Stage	2.0%	2.8%	2.3%	1.8%	2.2%	2.7%
Venture Late Stage	1.3%	1.7%	1.4%	1.1%	1.3%	1.6%
LBO	6.6%	4.4%	3.6%	2.8%	3.5%	4.4%
Mezzanine	0.8%	1.1%	0.9%	0.7%	0.9%	1.1%
Distressed Debt	0.3%	1.1%	0.9%	0.7%	0.9%	1.1%
Real Estate	5.0%	5.0%	5.0%	7.0%	8.8%	10.9%
Timber	-	-	2.0%	2.0%	2.5%	3.1%
Alternative Assets	16.0%	16.0%	16.0%	16.0%	20.0%	25.0%
Target Risk	11.8%	11.5%	11.1%	10.7%	10.8%	11.0%
95% Mark *)	15.7%	13.8%	13.2%	12.5%	13.1%	13.6%
Difference	3.9%	2.3%	2.1%	1.8%	2.3%	2.6%
Target Allocation	16.0%	16.0%	16.0%	16.0%	20.0%	25.0%
95% Mark *)	36.8%	30.7%	29.0%	27.2%	33.1%	39.0%
Difference	20.8%	14.7%	13.0%	11.2%	13.1%	14.0%
Equilibrium Return	8.21%	8.17%	8.05%	7.84%	8.05%	8.22%
Sharpe Ratio (GIM: 0.28)	**0.319**	**0.323**	**0.324**	**0.317**	**0.333**	**0.343**

- **He is significantly invested in alternative assets, but their diversification is fairly poor (concentration in LBO)**

- **Hence, our main objective is the reduction of the risk swings**

Biography: Renato Staub

Director, Asset Allocation & Risk Management

Education: Federal Institute of Technology (ETH), Zurich (Switzerland)	**MSc**
University of St. Gallen (Switzerland)	**MA, Ph.D**
Years of Investment Experience:	**9**

- Mr. Staub's responsibilities include risk and valuation analysis of alternative assets.
- He was involved in the development of alternative investments such as the global leveraged portfolio, market neutral portfolio, and risk controlled portfolio. This contained risk measurement and analysis, including stress testing and performance simulation. Further, he was involved in the administration of alternative asset portfolios.
- Prior to his move to Chicago, Mr. Staub worked as a quantitative analyst at Swiss Bank Corp., focusing on product development and risk analysis.