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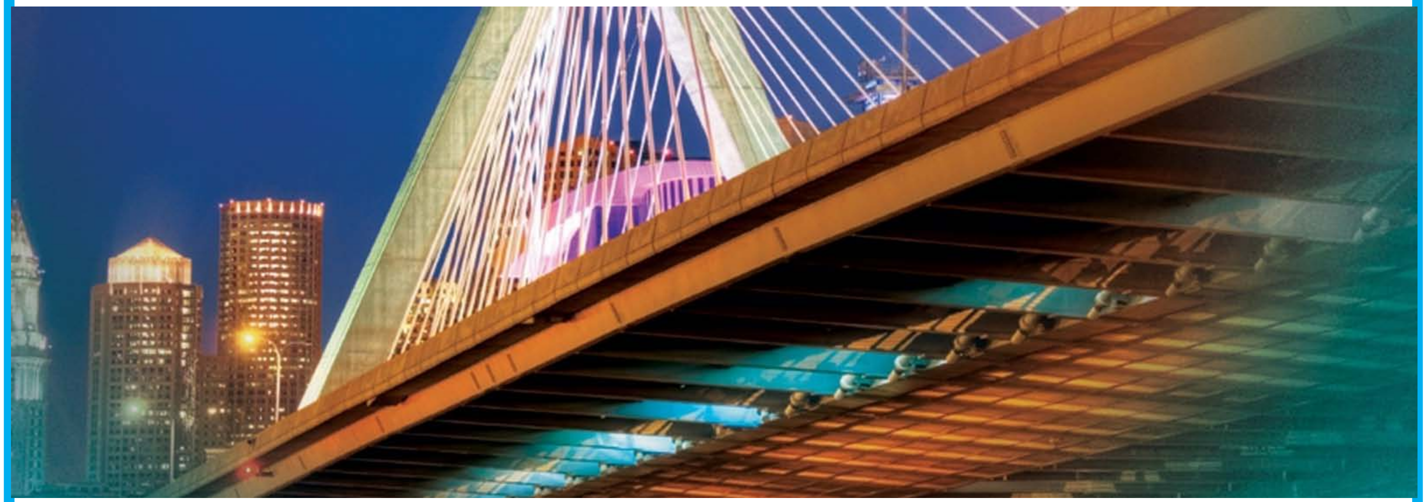

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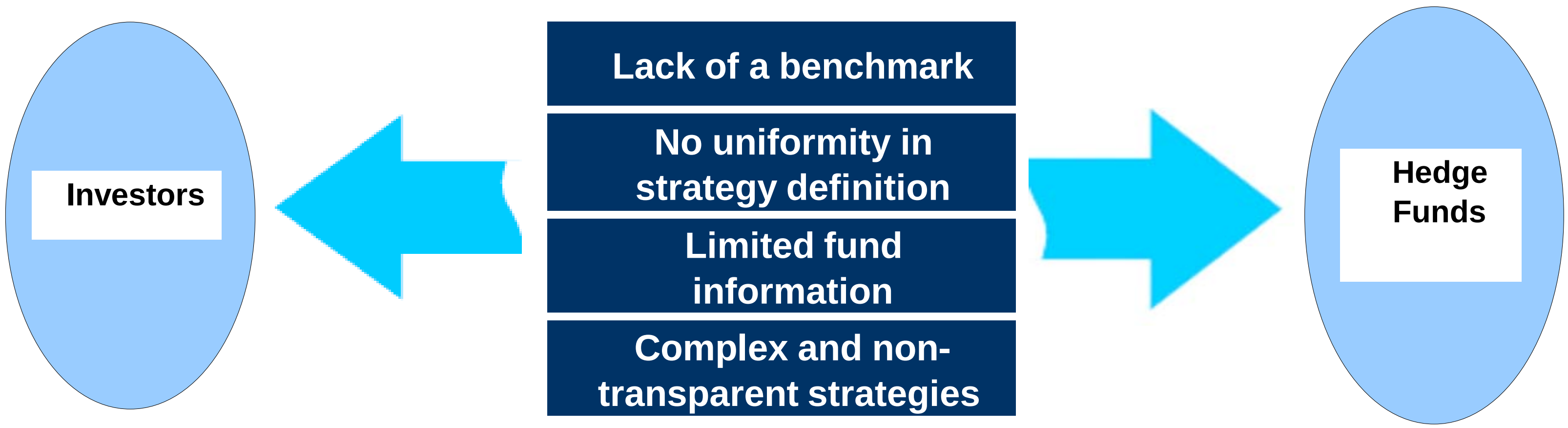
ALERT – ALgorithmic Evaluation of Returns

A Quantitative Framework for Analyzing Individual Hedge Fund Performance

October 2012

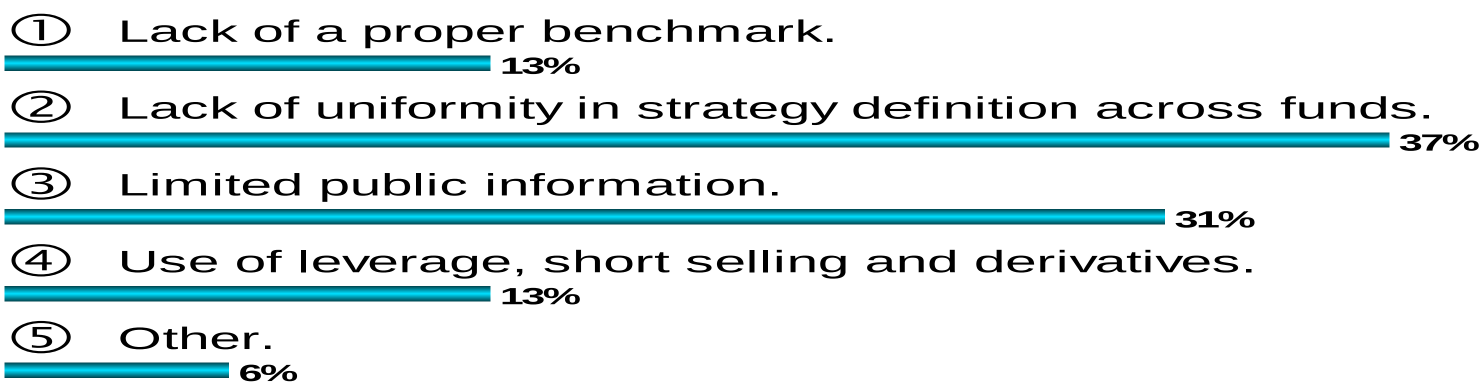
Evaluating Individual Hedge Funds

Challenges Faced by Investors when Evaluating Individual Hedge Funds



Feedback from Investors (2012 QPS Advisory Council)

What aspect do you find most challenging when evaluating hedge fund performance quantitatively?



Source: Barclays Research

ALERT – Algorithmic Evaluation of Returns

Quantitative Framework for Evaluating Hedge Funds

ALERT

Data Sources		Methodology		Goal
Fund		**Quantitative**		**Objective**
Commercial HF Databases	→	**Transparent**	→	**Flexible**
Barclays		**Innovative**		**Informative**

Topic Analyzed (Partial List)

1. Performance evaluation vs. peers
2. Identifying the drivers of hedge fund returns
3. Analysis of liquidity risk
4. Evaluating the benefit of a new strategy

Performance Evaluation vs. Peers

Traditional Approach	ALERT

Traditional Approach

- Composite indices as benchmark
  - HFRI, HFRX, DJCS, etc.[1]
- **Drawbacks in using an index**
  - Unattainable performance
  - Performance is upward biased
  - Does not capture single fund risk
  - Does not reflect style allocation (Multi-strategy/ FoF)
  - Difference between various indices

ALERT

- Individual peer funds as benchmark
  - **Objective**
    - Reflect "real" experience of investors
  - **Flexible**
    - Allows for customized peer groups which are tailored to clients (min AUM, history, liquidity provision, etc)
    - Allows for customized evaluation periods
  - **Informative**
    - Ranking of the fund relative to the distribution of peers
    - Separation of systematic and idiosyncratic changes

1. HFRI and HFRX: Hedge Fund Research Indices, DJCS: Dow Jones Credit Suisse Hedge Fund Indices.

Evaluating Systematic Strategies using ALERT

Performance Evaluation for ComBATS 6

Barclays ComBATS 6 Index

Index Description

- ComBATS 6 consists of long-short portfolios of commodity futures
  - Long a basket of Barclays Momentum Alpha Indices
  - Short a basket of standard nearby indices on the same underlying commodities
  - Extract alpha from the outperformance of a dynamic curve positioning strategy over a front strategy

- Key features:
  - Transparent and pre-defined algorithm
  - Non-directional: market-neutral to commodity exposure
  - Daily liquidity: No gates or lock-up period

- Launched in January 2009 with back-tested returns from February 2000

Source: Barclays Research

Peer Universe for ComBATS 6

Construction of Peer Universe for ComBATS 6

- Funds classified as Macro – Systematic Diversified in HFR database
  - *Macro: Systematic Diversified strategies have investment processes typically as function of mathematical, algorithmic and technical models, with little or no influence of individuals over the portfolio positioning*
- Funds were active during the index evaluation period and report monthly net of fees returns in USD
- Number of peer funds varies as a function of the evaluation period
  - Full sample (Feb 2000 – Jun 2012): 72 Funds
  - Sub samples:
    - First half (2000 – 2005, 139 funds) vs. Second (2006-2012, 157 funds)
    - Pre-launch vs. post-launch

ALERT Approach

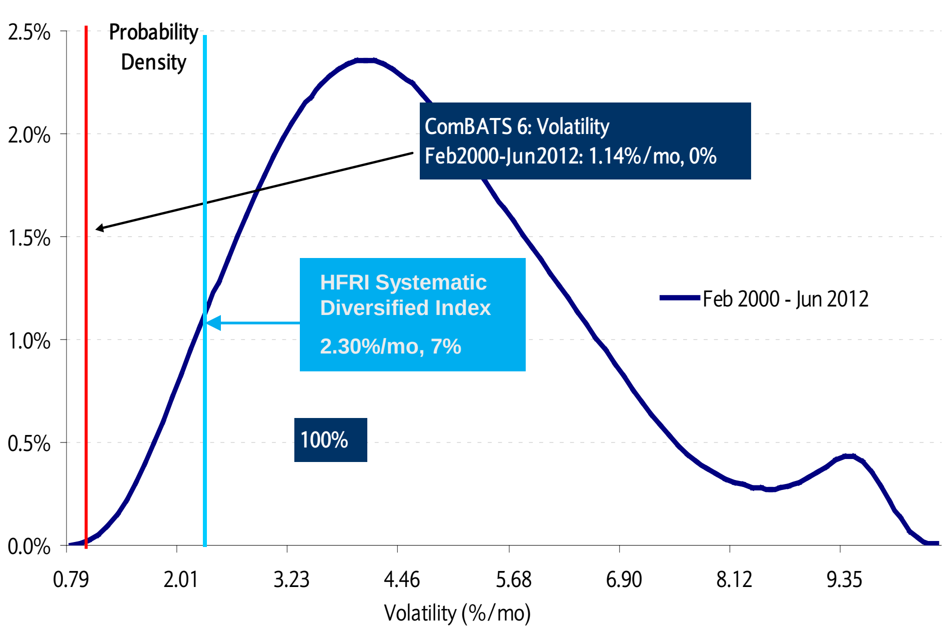
- Generate distribution of various performance/risk measures for peer funds
- Positioning the analyzed index on the distribution

ComBATS 6 vs. Peers – Risk Metrics

Performance Evaluation since Inception (Feb 2000 – Jun 2012)

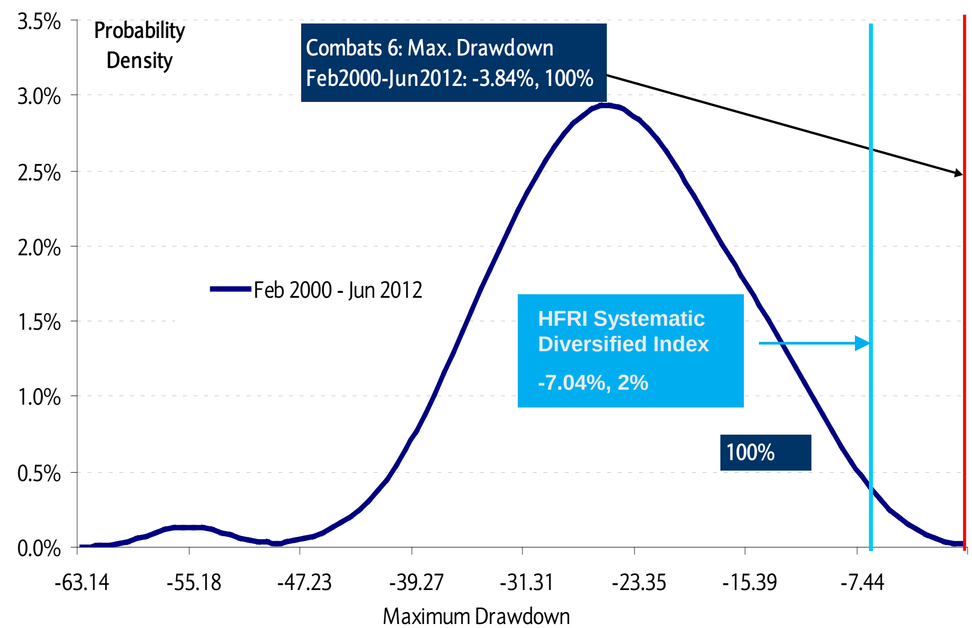
- Compared with its peers, ComBATS 6 had the lowest volatility and the smallest drawdown
- Not surprisingly, the HFRI Systematic Diversified index had much better risk properties than the median peer fund due to diversification
  - Only 7% of peer funds had lower volatility than the index

Monthly Volatility



Source: Hedge Fund Research, Barclays Research

Maximum Drawdown

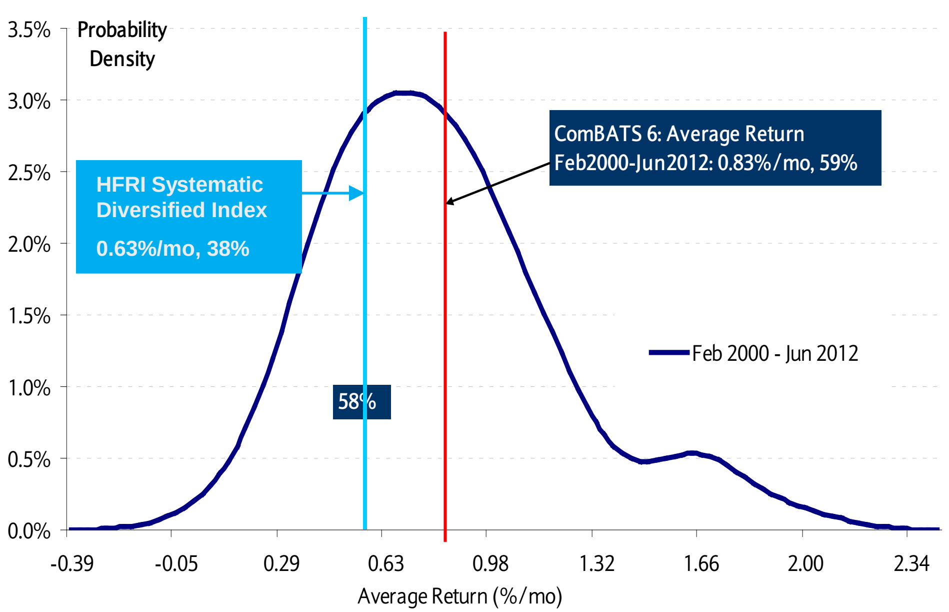


Source: Hedge Fund Research, Barclays Research

ComBATS 6 vs. Peers – Performance Metrics

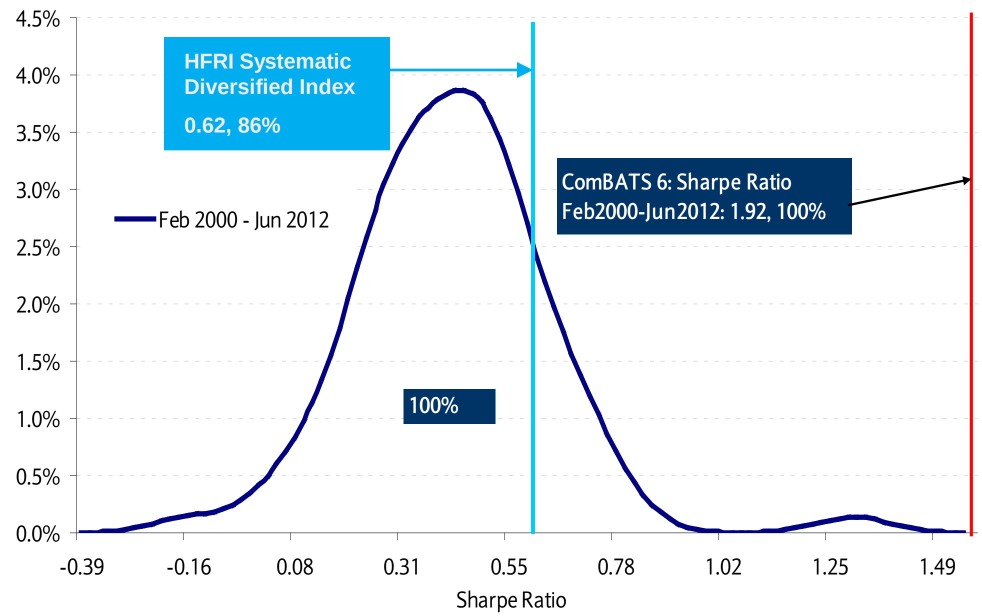
- Because of its low volatility, ComBATS 6 had the highest Sharpe ratio of all of its peers
  - In terms of absolute performance, ComBATS 6 has outperformed 59% of peers since its inception (Feb. 2000)
- However, returns of ComBATS 6 before January 2009 are backtested.
  - Were the superior performance of ComBATS due to backtesting?

Monthly Average Return



Source: Hedge Fund Research, Barclays Research

Sharpe Ratio



Source: Hedge Fund Research, Barclays Research

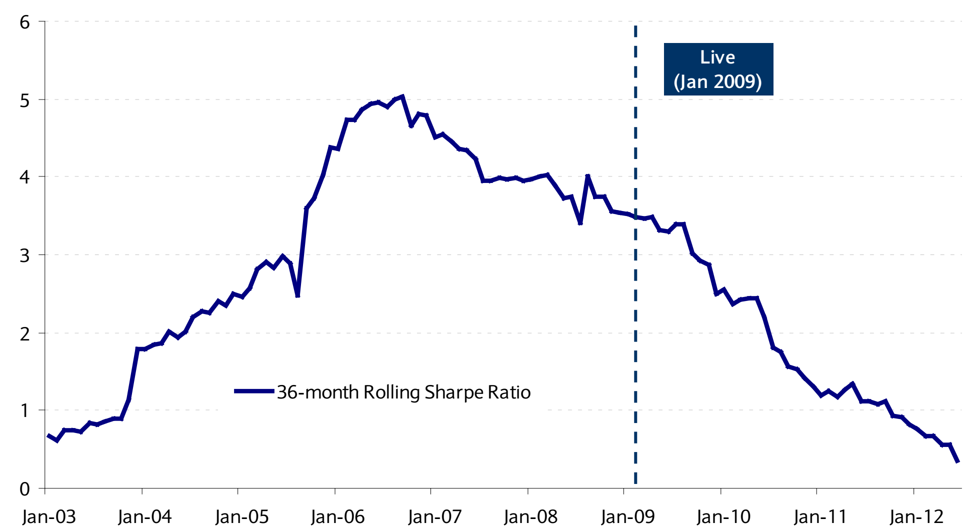
ComBATS 6 Performance – Pre vs. Post-Launch

- Pre-launch vs. post-launch
  - Avg. return: 1.07% vs. 0.29%/mo
  - Volatility: 1.09% vs. 1.05%/mo
  - Max. Drawdown: -3.84% vs. -3.73%
- Did the deterioration reflect the difference between back-tested performance and traded results?
- The decline in performance may have reflected market conditions as suggested by the indices performance
- Was ComBATS 6 performance more consistent when compared to peers?

Pre vs. Post-Launch Performance

	ComBATS 6	HFRI Macro Systematic Diversified	HFRX Macro Systematic Diversified
Panel A: Before Live (Febuary 2000 - December 2008)			
Average Return (%/mo)	1.07%	0.63%	0.55%
Volatility (%/mo)	1.09%	2.30%	3.13%
5% Percentile	-0.36%	-2.97%	-3.84%
Worst Month	-3.00%	-4.41%	-5.12%
Maximum Drawdown	-3.84%	-7.04%	-10.82%
Sharpe Ratio (%/mo)	2.48	0.62	0.16
Beta to SP500	0.02	0.13	-0.17
Panel B: Since Live (January 2009 - June 2012)			
Average Return (%/mo)	0.22%	0.10%	-0.21%
Volatility (%/mo)	1.05%	2.27%	2.59%
5% Percentile	-1.11%	-3.29%	-3.92%
Worst Month	-2.56%	-3.55%	-4.84%
Maximum Drawdown	-3.73%	-7.04%	-10.82%
Sharpe Ratio (%/mo)	0.65	0.12	-0.31
Beta to SP500	0.00	0.04	-0.13

36-month Rolling Sharpe Ratio

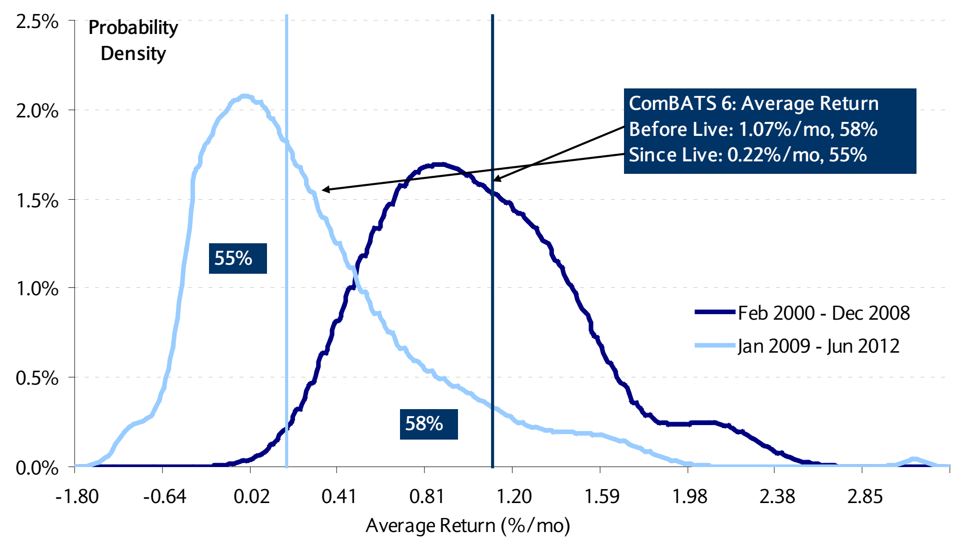


Source: Hedge Fund Research, Barclays Research

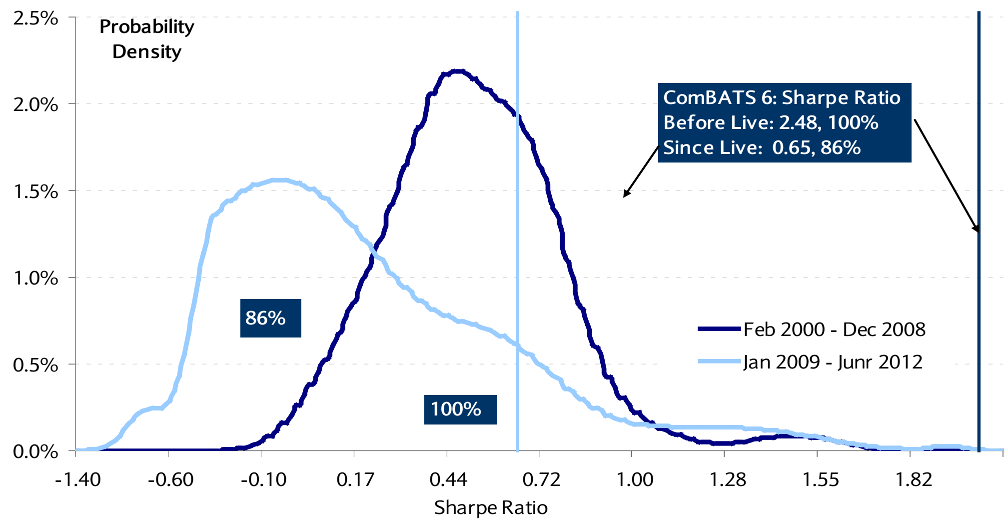
Performance Ranking vs. Peers Was Unchanged

- Despite significant changes in absolute performance, ComBATS 6 delivered remarkably **similar performance relative to its peers**
    - Average return: better than 58% and 55% of peers both before and after live
    - Sharpe ratio: outperforming close to 90% of peers both before and after the launch
- Results suggest that the decline in ComBATS 6' absolute return was driven by factors common to all funds employing similar systematic strategies, and not because of back-testing

Monthly Average Return



Sharpe Ratio

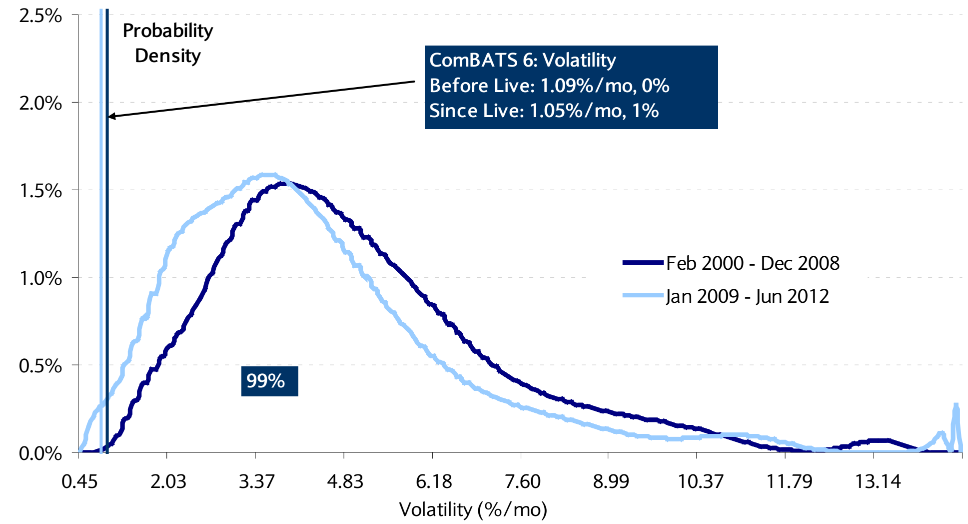


Source: Hedge Fund Research, Barclays Research

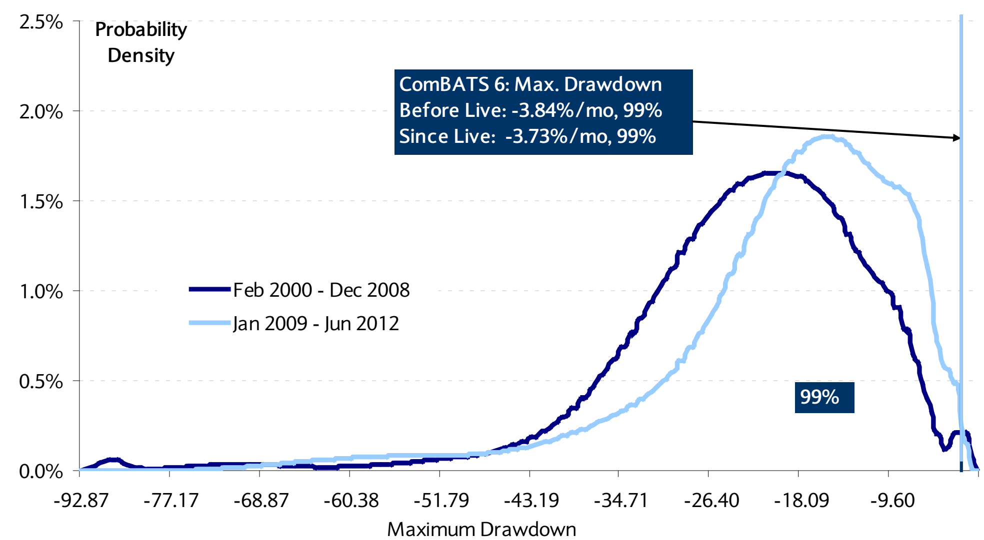
Risk Characteristics Remained Stable

- ComBATS 6 risk properties were stable, on both absolute and relative basis
  - Lower Volatility & Max. Drawdown than 99% of peers before and after the launch
- In comparison with hedge funds employing systematic strategies, ComBATS 6 offers
  - Consistent performance better than about 90% of peers
  - Stable and attractive risk properties

Monthly Volatility



Maximum Drawdown

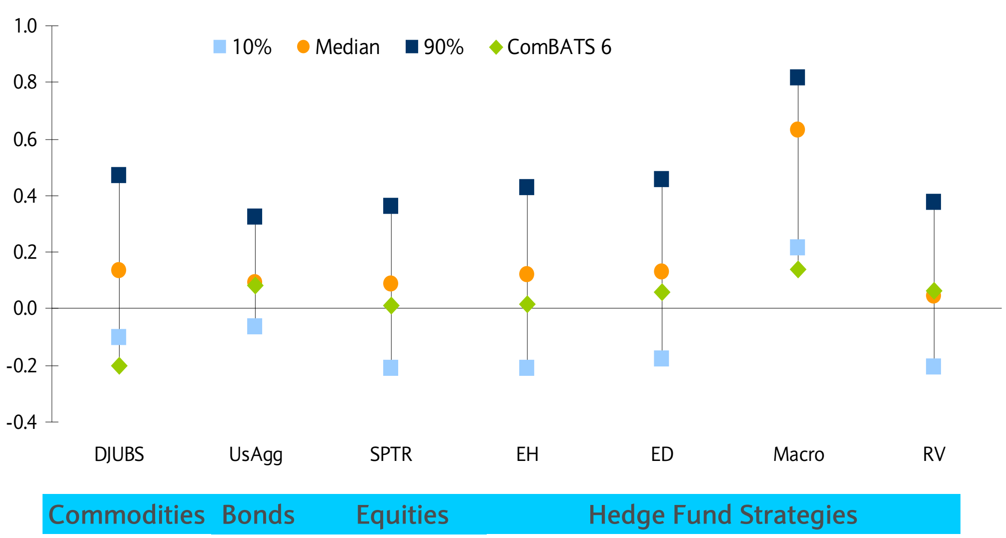


Source: Hedge Fund Research, Barclays Research

ComBATS 6 vs. Peers – Diversification Benefit

- Relative to its peers, ComBATS exhibits lower correlations with broad indices representing different asset classes
  - Commodities (DJUBS): -0.20 and lower than 94% of peers
  - Macro (Alternatives): 0.14 and lower than 93% of peers
- Correlations of ComBATS with broad indices were stable over time on both absolute and relative basis
- Results imply ComBATS offers greater diversification benefits compared with peer funds

Correlations with Broad Indices (since Jan2009)



Source: Hedge Fund Research, Bloomberg, Barclays Research

Correlation Stability

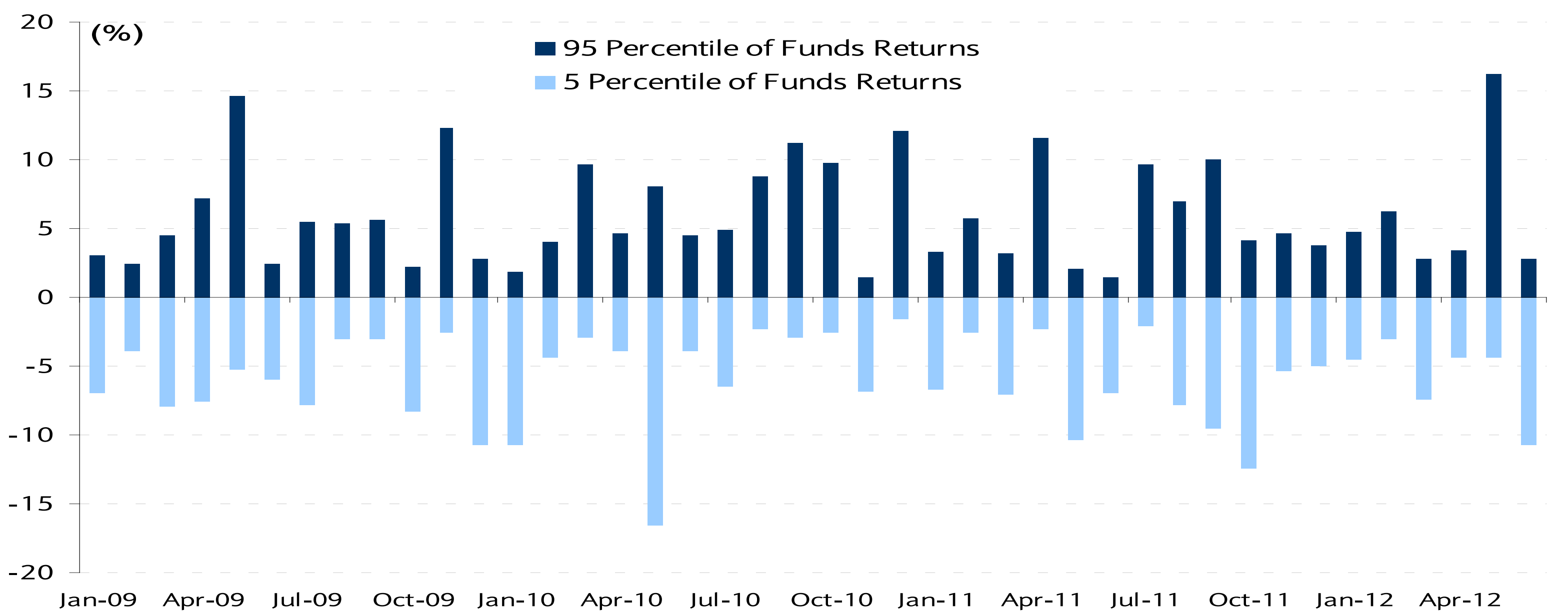
	DJUBS (Commodities)	UsAgg (Bonds)	SPTR (Equities)	Equity Hedge (Alternatives)	Event Driven (Alternatives)	Macro (Alternatives)	Relative Value (Alternatives)
Before Live (Feb 2000 - Dec 2008)							
Correlation	-0.23	-0.10	0.09	0.00	0.02	-0.07	0.00
Lower than % of Peers	99%	96%	9%	39%	34%	94%	36%
After Live (Jan 2009 - Jun 2012)							
Correlation	-0.20	0.08	0.01	0.02	0.06	0.14	0.06
Lower than % of Peers	94%	51%	65%	61%	59%	93%	47%

Note: DJUBS: Dow Jones UBS Commodity Total Return Index; USAgg: Barclays US Aggregate Bond Index; SPTR: S&P 500 Total Return Index, Equity Hedge, Event Driven, Macro and Relative Value are HFRI Equity Hedge, Event Driven, Macro, and Relative Value Index respectively. Sources: Bloomberg, Barclays Research

ComBATS 6 vs. Peers – Selection Risk

- ComBATS 6 is based on transparent rules and has no manager selection risk
- Investing in hedge funds is subject to significant manager selection risk
  - Monthly return dispersion (the difference between 95 and 5 percentile of monthly return) typically above 10%
  - Leaving of key personnel further increases the uncertainty investors face

Monthly Return Dispersion of CTA Funds



Source: Hedge Fund Research, Barclays Research

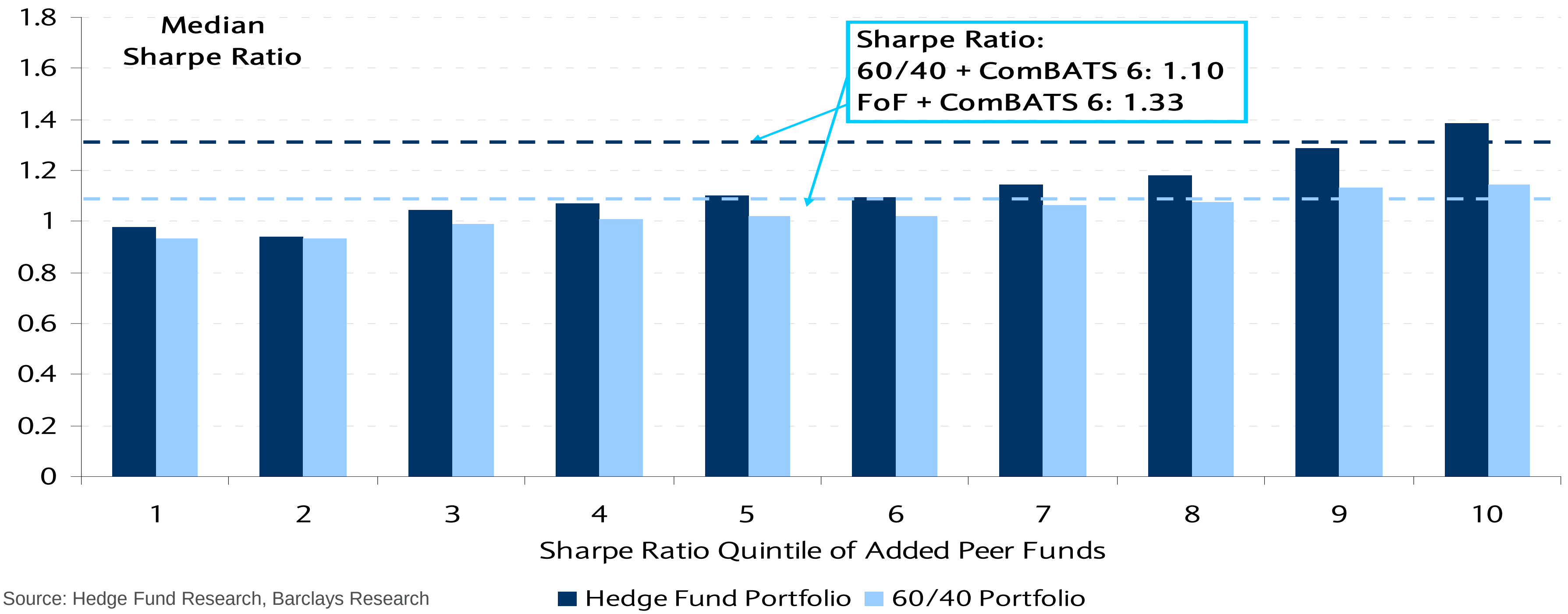
ComBATS vs. Peers - Benefit to an Existing Portfolio

- Evaluate ComBATS 6 not in isolation, but in conjunction with an existing investor portfolio
- Typical investor portfolio:
  - 60/40 pension fund: 60% Equity (S&P 500) and 40% Fixed Income (US Agg)
  - Fund of funds: Equal-weighted portfolio of four broad HFRI indices (Equity Hedge, Event-Driven, Macro and Relative Value)
- Methodology:
  - Calculate Sharpe ratio for each peer fund
  - Peers are ranked by their Sharpe ratios, then assigned to quintiles
    - Quintile 1 includes funds with the lowest Sharpe ratios among all funds
  - For each peer fund, a hypothetical portfolio is constructed using returns from the investor portfolio and the peer fund
  - Report the median of Sharpe ratios for all hypothetical portfolios in the same quintile

Benefit to an Existing Portfolio – Full Evaluation Period

- Assuming a 15% allocation to ComBATS 6 or its peer
- ComBATS 6 vs. peers since launch date (January 2009 – June 2012)
  - The S.R. of the 60/40 portfolio would be higher compared with adding 80% of peers
  - The FoF portfolio would have a better S.R. than 90% of peers

Sharpe Ratio of Combined Portfolio (Jan 2009 – Jun 2012)



Source: Hedge Fund Research, Barclays Research

Evaluating Systematic Strategies using ALERT

Performance Evaluation for Q-MA

Barclays Q-MA Index

Index Description

- Barclays Q-MA index
  - Systematic merger arbitrage strategy
  - Merger arbitrage profits from the “deal spread”, the difference between the current price of the target and the offered price
  - The spread reflects the risk of the deal failure

- Key features:
  - Transparent and pre-defined algorithm
  - Daily liquidity: No gates or lock-up period
  - Position hedged against broad market movements

- Launched in January 2010 with back-tested returns start from Feb. 2005

Performance Evaluation vs. Peers

Constituents of Barclays Q-MA Peer Universe

- Peer Universe:
  - Funds that classified as Merger Arbitrage in three different databases: HFR, TASS and HFN.
  - Were available to investors during the evaluation period
- Number of peers
  - Full evaluation period (Feb. 2005 – Jun 2012): 53
  - First half (Feb. 2005 – Dec. 2008): 71
  - Second half (Jan. 2009 – Jun. 2012): 61
  - Since launch (Jan. 2010 – Jun. 2012): 71

ALERT Approach

- Generate distribution of various performance/risk measures for peer funds
- Positioning the analyzed index on the distribution
- Evaluate performance stability in relative rankings.

Q-MA vs. Peers - Summary

- Over the full evaluation period (Feb. 2005 – Jun. 2012), Q-MA was ranked at 65% on both absolute and risk-adjusted basis
- Performance declined during the second half (Jan. 2009 – Jun. 2012) due to deterioration of relative risk properties
- There are noticeable drops in performance after the index became live.

Performance Statistics of Q-MA vs. Peers

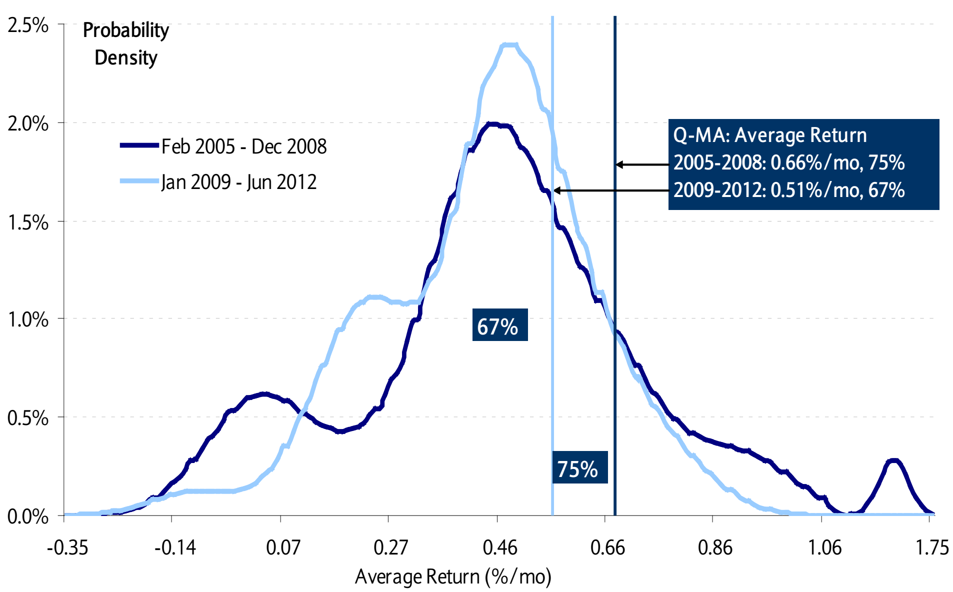
	Performance			Risk		
	Monthly Return	Sharpe Ratio	Monthly Volatility	95% VaR	Worst Month	Max. Drawdown
Full Evaluation Period (Feb. 2005 - Jun 2012) - 37 Funds						
Statistics	0.59%	0.96	1.41%	-1.22%	-3.72%	-3.72%
Ranking Pct	65%	65%	59%	62%	57%	76%
1st Evaluation Period (Feb. 2005 - Dec. 2008) - 51 Funds						
Statistics	0.66%	0.73	1.47%	-0.87%	-3.72%	-3.72%
Ranking Pct	75%	67%	49%	92%	55%	73%
2nd Evaluation Period (Jan. 2009 - Jun 2012) - 42 Funds						
Statistics	0.51%	1.25	1.35%	-1.65%	-2.09%	-3.43%
Ranking Pct	67%	40%	71%	29%	43%	48%
Live (Jan. 2010 - Jun. 2012) - 49 Funds						
Statistics	0.29%	0.72	1.28%	-1.67%	-1.86%	-3.43%
Ranking Pct	39%	27%	78%	31%	51%	43%

Source: Hedge Fund Research, Barclays Research

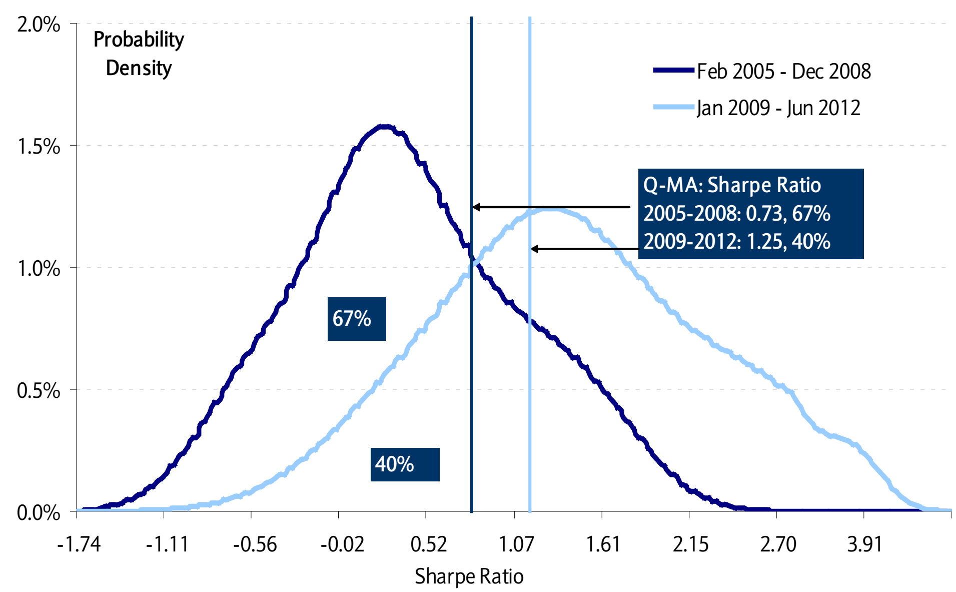
Q-MA Performance Stability – Absolute vs. Relative

- While its Sharpe ratio increased from 0.73 to 1.25, Q-MA's Sharpe ratio ranking declined from 67% to 40%.
- Performance of merger arbitrage funds improved significantly during the second half (Jan. 2009 – Jun. 2012) as the market reversed.
  - Improved Sharpe ratios are not due to increased returns but reduced volatilities.

Monthly Average Return



Sharpe Ratio

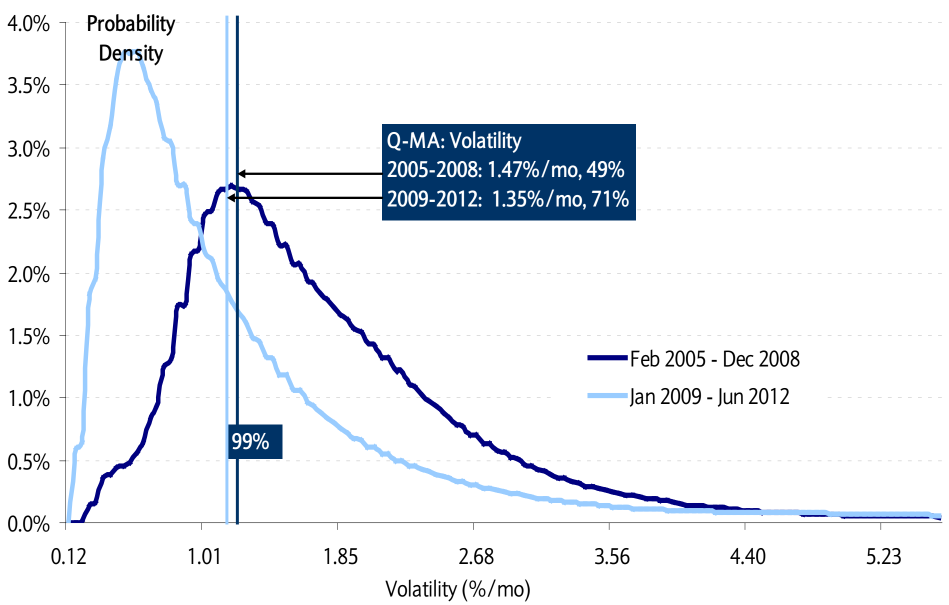


Source: Hedge Fund Research, Barclays Research

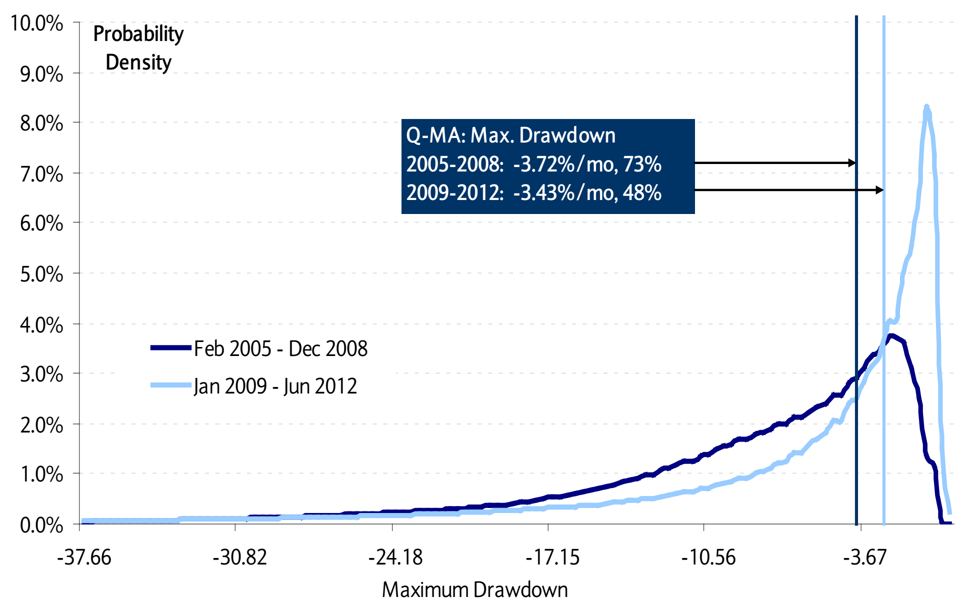
Q-MA vs. Peers – Risk Metrics

- As suggested in previous results, Q-MA exhibited worse rankings in risk despite very similar statistics
  - Monthly volatility: 1.47% to 1.35% (49% to 71%)
  - Max. Drawdown: -3.72% to -3.43% (73% to 48%)

Monthly Volatility



Max. Drawdown



Source: Hedge Fund Research, Barclays Research

Q-MA vs. Peers – Market Illiquidity Exposures

Is the performance difference between Q-MA and its peers driven by illiquidity?

Measures of Market Illiquidity

- We use two different measures of market illiquidity:

  1. Indirect - Return difference between cash and derivatives (RBI vs. Us Agg.)

  2. Direct - LCS (Liquidity Cost Scores)

Quantifying Funds' Market Illiquidity Exposures

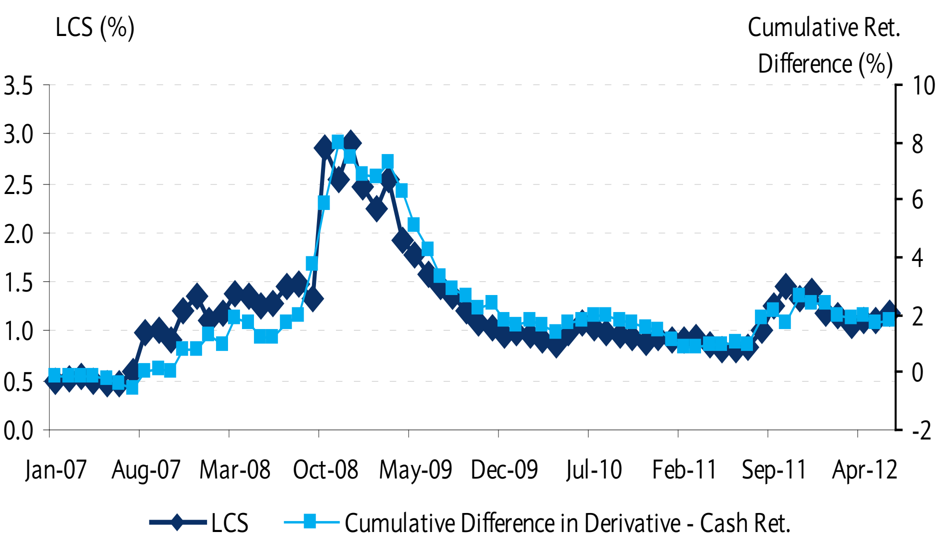
- We estimate a fund's exposure to illiquidity by regressing its returns on illiquidity factors returns
- We compare a fund's exposure to illiquidity proxies relative to those of its peers

Measures of Market Illiquidity

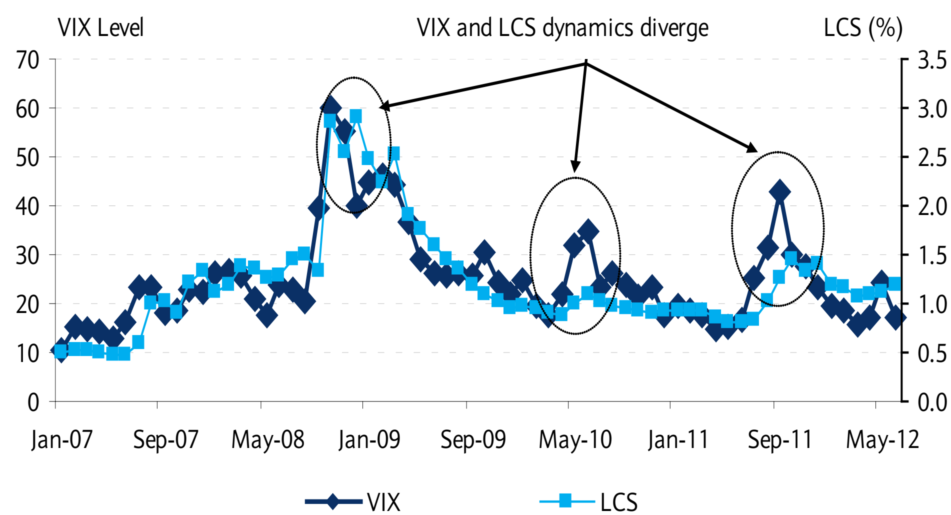
1. **Direct** – LCS (Liquidity Cost Score) available since Jan. 2007
   - ➢ The round-trip transaction cost for a standard institutional trade in a corporate bond
2. **Indirect** - Return difference between RBI (derivatives) and US Agg. (cash) (since Apr 2004)
   - ➢ RBI: Replicating Bond Index basket (basket of derivatives tracking US Agg returns)
   - ➢ Derivatives outperform cash instruments when market liquidity deteriorates

- Both measures are highly correlated
  - They tend to co-move with changes in the VIX index with episodes of divergence

Cumulative Tracking Error vs. LCS



LCS vs. VIX



Source: Bloomberg, Barclays Research

Returns and Market Illiquidity

- Regression of fund returns on illiquidity proxies and control variables
  - Market directionality (S&P 500) and volatility (S&P 500 and VIX chg)
- Coefficients of both liquidity proxies indicate that the fund has no exposure to illiquidity (statistically and economically insignificant)
  - Negative exposure to S&P 500
- While 80% of its peers have negative coefficients (fund suffers when illiquidity increases), most of them are statistically insignificant.

Estimates of Illiquidity Exposure using Basis Chg

Q-MA Regression Summary

Regression Statistics	
Multiple R	0.24
R Square	0.06
Adjusted R	0.03
Standard Er	1.39
Observatio	89

Peer Illiquidity Exposure Summary

Percentage of Peers	
Negative Coef. On TE	81%
Negative & signficiant Coef on TE	19%

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.64	0.15	4.25	0.00	0.34	0.94	0.34	0.94
TE	0.10	0.42	0.23	0.82	-0.74	0.93	-0.74	0.93
S&P 500	-0.10	0.05	$\boxed{-2.04}$	0.04	-0.20	0.00	-0.20	0.00
VIX Chg	-0.05	0.04	-1.26	0.21	-0.14	0.03	-0.14	0.03

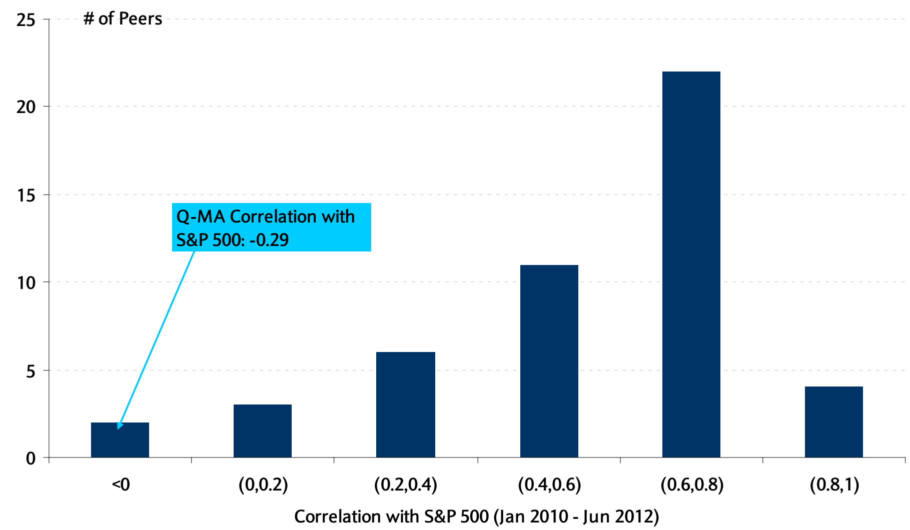
Source: Bloomberg, Barclays Research

Q-MA vs. Peers – Exposure to S&P 500

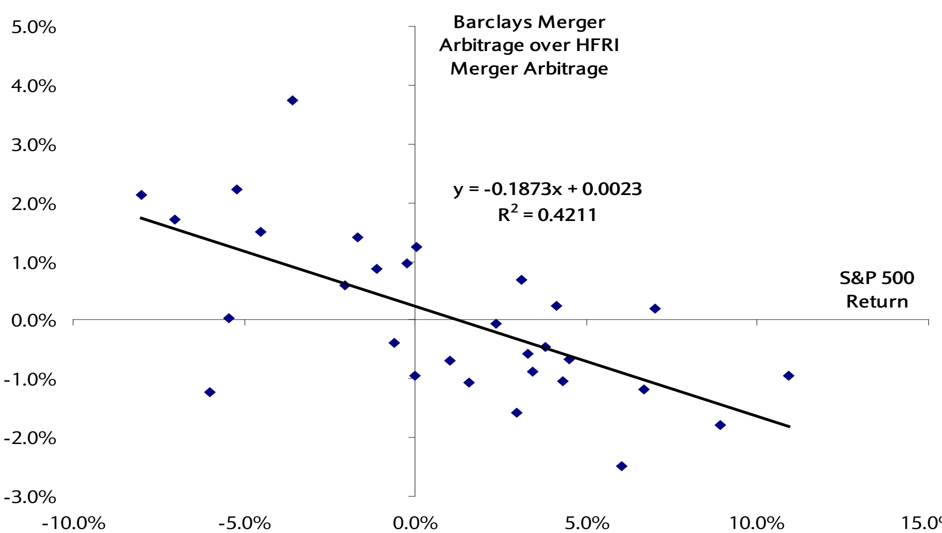
Is the deterioration in performance related to hedging?

- Q-MA index dynamically hedge beta to the equity market.
  - It worked well during the crisis. For example, in Oct. 2008, the index gained 6.71% vs. HFRI Equity Hedge lost 2.47%. (S&P lost 16.79%)
- However, is the index over-hedging its equity exposure after launch?
  - Q-MA has the lowest correlation (-0.29) with S&P 500 vs. peers
  - Excess ret. of Q-MA over HFRI Merger Arb. have -0.65 correlation with S&P

Correlation with S&P 500



Excess Return of Q-MA over HFRI Merger Arbitrage vs. S&P



Source: Bloomberg, Barclays Research

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