



Anchor to Windward – Aligning Absolute Return Objectives

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Motivation

- Absolute return, broadly, incorporates a range of strategies with focus on investment objectives such as:
 - performance consistency,
 - lower tail risk, and
 - downside diversification

- Breadth of potential sources for this kind of “liquid absolute return” can make the identification and evaluation of strategies challenging

- We recommend different performance metrics to evaluate different investment objectives

See: Scott D. Stewart, “Is Consistency of Performance a Good Measure of Manager Skill?” *Journal of Portfolio Management* 24, no. 3 (Spring 1998): 22-32, wherein the author found that more consistent managers were more likely to demonstrate higher subsequent annualized returns.

Findings

On average, we found that:

- **Absolute Return, Event Driven, and Credit Long Short** strategies provided relative consistency (as measured by the Anchor ratio), together with attractive risk-adjusted returns
- **Equity Long Short** was attractive from a risk-adjusted return perspective
- **Absolute Return, Multi Strategy, Event Driven, and Discretionary Macro** were most effective in controlling tail risk
- **Managed Futures** alone stood out for downside diversification

Methodology

- Used eVestment Hedge database to identify absolute return-style funds
 - Included only those funds with reported performance for the entire period from January 2008 to December 2016
 - Screened for more “liquid” absolute return funds, included funds with monthly, or more frequent, redemption terms
 - Majority of funds reported on a net of fees basis, we excluded funds reporting gross of fees
 - Many self-defined “absolute return” funds have, in fact, significant market exposures, we eliminated any fund that demonstrated a beta of greater than or equal to 0.5, or less than or equal to -0.5, to traditional equity and bond index returns

- Strategy-level averages were calculated only for those categories that had at least five funds meeting all of the criteria, resulting in a total of 287 funds across strategies

- We analyzed results at the strategy level, based on the products’ reported “main strategy,” which was self-defined by reporting managers

Methodology (2)

- The resulting funds comprised several strategy types: Multi Strategy, Event Driven, Volatility, Credit Long Short, Equity Long Short, and Macro (all within the “Hedge Funds” asset class), as well as Absolute Return (within the “Alternatives” asset class)
- To evaluate this broad set of strategies relative to absolute return-oriented objectives, we focus on
 - 95% conditional value-at-risk (CVaR),
 - downside equity correlation when equities are down more than half standard deviation from the mean, and
 - “Anchor ratio” (AR), a new measure that is designed to capture the consistency of absolute returns

Note: See Appendix for fund counts and additional screening details

Traditional Performance Metrics

- Moderate annual net of fees performance of three to five percent across the strategies;
 - Credit Long Short was an exception, with close to eight percent annual return
- Strategies also had low to moderate annual volatility, ranging from 5.7% (Event Driven) to 11.4% (Macro)
- Event Driven and Credit Long Short strategies had superior risk-adjusted returns, with Sharpe ratios of 0.86 and 0.75 respectively
- Downside risk perspective (Maximum Drawdown, 95% CVaR), Absolute Return and Multi Strategy, in addition to Event Driven strategies, delivered strong results

eVestment Hedge (Net Returns)	Count	Return	Risk	Sharpe ratio	Sortino ratio	95% VaR	95% CVaR	Maximum Drawdown
		Annual			Monthly			
Absolute Return	20	3.7%	8.3%	0.52	1.32	-3.2%	-4.8%	18.6%
Multi Strategy	40	3.3%	6.8%	0.48	1.21	-2.7%	-4.5%	18.4%
Event Driven	13	4.3%	5.7%	0.86	1.98	-2.2%	-4.0%	13.6%
Volatility	9	5.4%	13.9%	0.38	0.66	-5.9%	-10.0%	29.0%
Credit Long Short	8	7.8%	9.7%	0.75	1.24	-2.2%	-6.2%	28.4%
Equity Long Short	79	4.9%	9.3%	0.47	0.96	-3.8%	-5.4%	19.5%
Macro	118	3.4%	11.4%	0.24	0.50	-4.6%	-6.4%	23.2%

Note: USD returns, January 2008 – December 2016. Please see Appendix for performance metrics definitions. Please note that the Macro group represents primarily (a) Discretionary Macro and (b) Managed Futures; the number of eligible funds in GTAA, Systematic Macro, Fixed Income Relative Value and Foreign Exchange sub-strategies were fewer than five each; as such, the results presented here are not meant to be representative of those sub-strategies. **Past performance is not a guarantee or a reliable indicator of future results.**

Source: PGIM IAS, eVestment. For illustrative purposes only.

Anchor Ratio as a Measure of Consistency

- Consistency of performance has been shown to be a potential indicator of skill
 - is commonly measured using the concept of “hit rate”, defined as the ratio of the number of correct decisions as a percentage of total decisions
 - Missing from this concept is the notion of performance sustainability, how long can a manager hit without having a miss?
- We introduce the “Anchor ratio” as a measure of consistency, which captures not only the frequency of positive outcomes, but the degree to which a fund generates *sustained* positive outcomes
 - If fund performance is positive for any given month, we call this a “hit,” and otherwise, a “miss”
 - We call consecutive hits “a hit run,” with each hit run score denoted by h
 - Similarly, we call consecutive misses “a miss run,” with each miss run score denoted by m
 - Anchor ratio (AR) defined as (p is the number of hit runs, and q is the number of miss runs):

$$AR = \sqrt{\frac{\sum_{i=1}^p h_i^2}{\sum_{i=1}^q m_i^2}}$$

See: Michael Villaverde, “Measuring investment performance consistency,” *Quantitative Finance* 10, no. 6 (June 2010): 565-574, wherein the author proposes combining information ratio, maximum drawdown and maximum breakeven time capture the cumulative impact of consistent, or inconsistent, performance.

Anchor Ratio a Path Dependent Measure

- While two managers may have similar overall performance (i.e., return, risk and “hit rate”) over a given period, their Anchor ratios can be very different
- A greater Anchor ratio indicates more sustained and consistent positive performance
 - For example, return series #1 has three runs: one hit run (score five) and two miss runs (scores of one and two), the Anchor ratio for series #1 is 2.24
 - In contrast, return series #2 has six runs: three hit runs (the first two with score two, and the third with score one) and three miss runs (each with a score of one), the Anchor ratio for series #2 is 1.73

Return Series	1	2	3	4	5	6	7	8
#1	-	+	+	+	+	+	-	-
#2	-	+	+	-	+	+	-	+

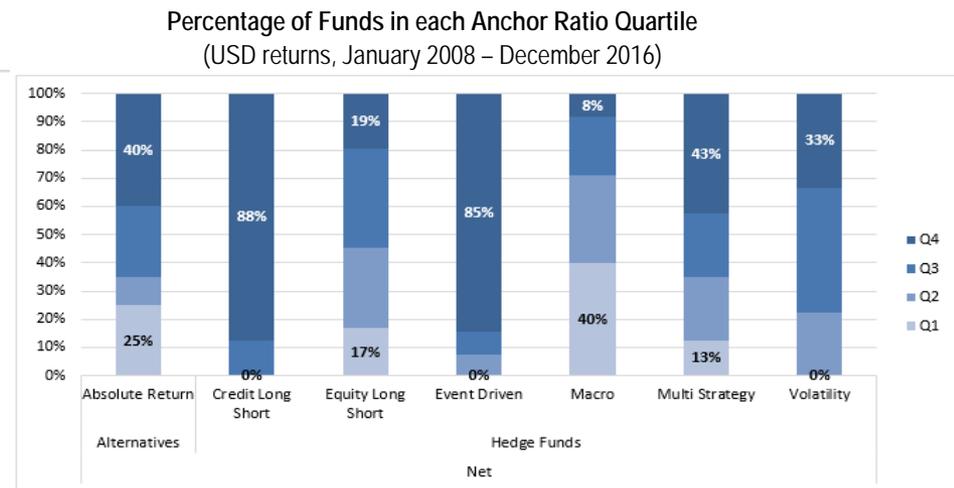
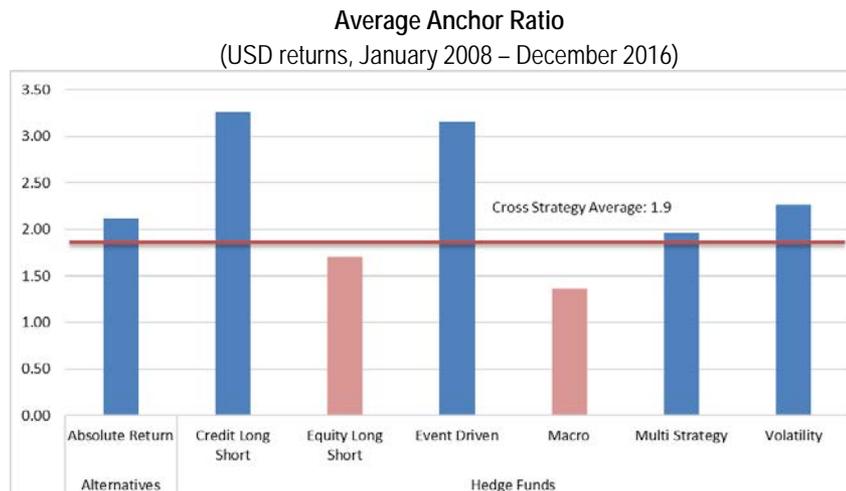
Return series	Hit run scores				Miss run scores				Sum of squared hit runs (a)	Sum of squared miss runs (b)	Anchor ratio Sqrt(a/b)
#1	5				1	2			25	5	2.24
#2	2	2	1		1	1	1		9	3	1.73

Note: Hypothetical return series.

Source: PGIM IAS, eVestment. For illustrative purposes only.

Sustainability of Positive Results

- Absolute Return, Credit Long Short, Event Driven, Multi Strategy, and Volatility strategies all demonstrated higher than average AR (1.9)
 - Equity Long Short and Macro delivered relatively lower performance sustainability
- Funds with Anchor ratio greater than 2.04 rank in top quartile (Q4)
 - 88% of the Credit Long Short (7 out of the 8), 85% of the Event Driven (11 out of the 13), 40% of Absolute Return, and 43% of Multi Strategy were in the top quartile
 - Only 19% of Equity Long Short and 8% of Macro in the top quartile



Note: Anchor ratio at the strategy level is determined by the equal weighted average of all funds' Anchor ratios in that strategy. The average Anchor ratio of all funds was 1.9. The strategies with higher than average Anchor ratio are in blue (Absolute Return, Credit Long Short, Event Driven, Multi Strategy and Volatility), and others (Equity Long Short and Macro) are in red. Please note that the Macro group represents primarily (a) Discretionary Macro and (b) Managed Futures; the number of eligible funds in GTAA, Systematic Macro, Fixed Income Relative Value and Foreign Exchange sub-strategies were fewer than five each; as such, the results presented here are not meant to be representative of those sub-strategies. Source: PGIM IAS, eVestment. For illustrative purposes only.

Anchor Performance in Test Cricket

- 11 of the 13 batsmen achieving more than 10,000 runs were top order anchor batsmen, at positions 3 – 5



Terminologies in Cricket

Anchor

A top-order batsman capable of batting for a long duration throughout the innings. Usually batsmen playing at numbers 3 or 4 play such a role, especially if there is a batting collapse. An anchor plays defensively, and is often the top scorer in the innings

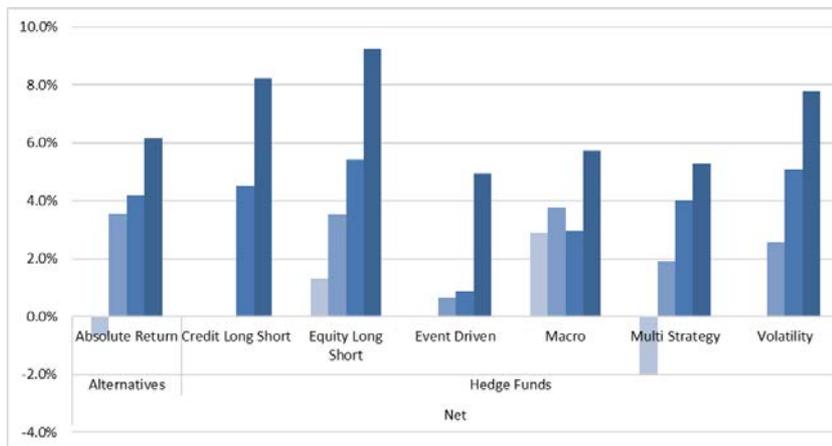
Player	Team	Debut	Retirement	Matches	Innings	Runs	Average	100s	50s
Kumar Sangakkara	Sri Lanka	2000	2015	134	233	12,400	57.40	38	52
Jacques Kallis	South Africa	1995	2013	166	280	13,289	55.37	45	55
Sachin Tendulkar	India	1989	2013	200	329	15,921	53.78	51	68
Brian Lara	West Indies	1990	2006	131	232	11,953	52.88	34	48
Rahul Dravid	India	1996	2012	164	286	13,288	52.31	36	63

Source: https://en.wikipedia.org/wiki/Glossary_of_cricket_terms
<http://www.howstat.com.au/cricket/Statistics/Batting/BattingBestAggregateForPosition.asp>
https://en.wikipedia.org/wiki/List_of_players_who_have_scored_10,000_or_more_runs_in_Test_cricket
<https://www.justdial.com/photos/> For illustrative purposes only.

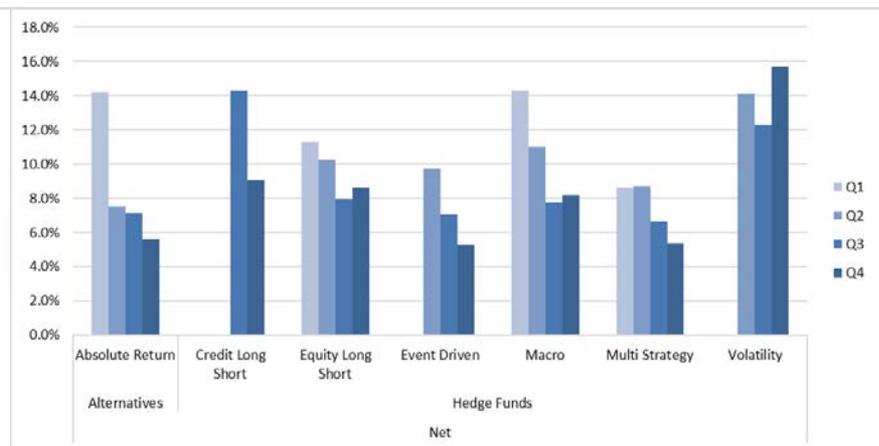
Anchor Ratio and Performance

- In a game of cricket, the anchor is a top-order batsman capable of batting for a long duration throughout the innings, despite playing defensively, the anchor is often the top scorer
- We find superior performance associated with the funds in the top Anchor ratio quartile, despite the fact that calculation of the Anchor ratio does not incorporate the magnitude of performance
- For the most part, top quartile (Q4) Anchor ratio funds also had lower volatility

Average return sorted by Anchor ratio quartile



Average volatility sorted by Anchor ratio quartile



Note : USD returns, January 2008 – December 2016. We rank all funds across all asset classes based on their Anchor ratio in ascending order and then take performance averages in each quartile. The returns and volatility are annualized averages. Please note that the Macro group represents primarily (a) Discretionary Macro and (b) Managed Futures; the number of eligible funds in GTAA, Systematic Macro, Fixed Income Relative Value and Foreign Exchange sub-strategies were fewer than five each; as such, the results presented here are not meant to be representative of those sub-strategies. Source: PGIM IAS, eVestment. For illustrative purposes only. Past performance is not a guarantee or a reliable indicator of future results.

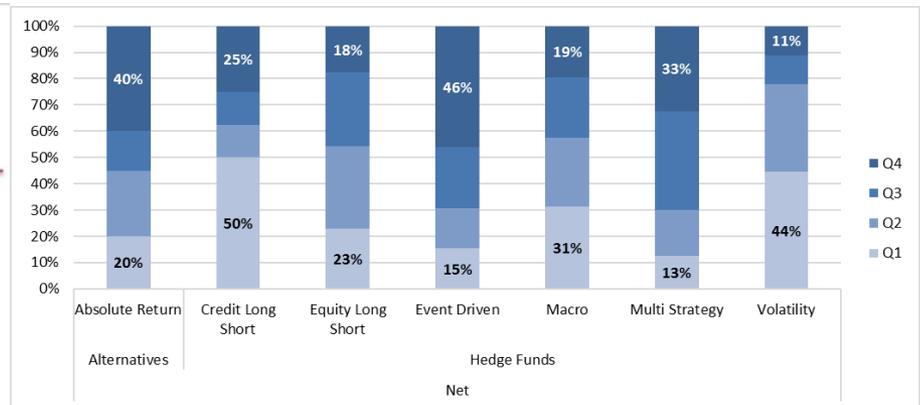
Tail Risk

- Event Driven, Multi Strategy and Absolute Return strategies demonstrated relatively limited downside risk (better than -5% 95% CVaR at the one-month horizon)
- Strategies scoring well (top quartile, Q4, with low CVaR) included:
 - Event Driven (46%), Absolute Return (40%), and Multi Strategy (33%), these strategies appeared to be more likely to contain extreme events
- 50% of Credit Long Short, 44% of Volatility and 31% of Macro funds were in the worst quartile, likely to expose the investor to larger losses on the downside

Average One Month 95% CVaR
(USD returns, January 2008 – December 2016)



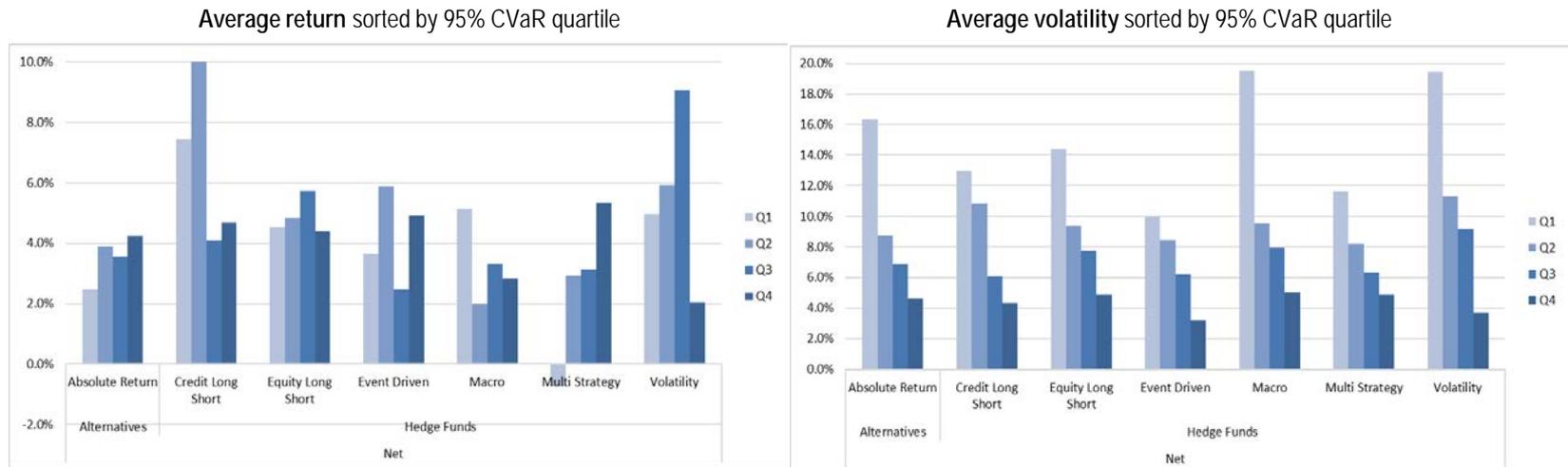
Percentage of Funds in each 95% CVaR Quartile
(USD returns, January 2008 – December 2016)



Note: We calculate 95% CVaR for every fund over the evaluation period, and use this to calculate equal weighted averages at the strategy level. 95% CVaR is the average left tail performance, based on monthly returns at the 5th percentile or lower. The average 95% CVaR of all funds evaluated here was -5.6%. The strategies with an average 95% CVaR less severe than the overall average are presented in blue (Absolute Return, Equity Long Short, Event Driven and Multi Strategy), and others (Credit Long Short, Macro and Volatility) are in red. Please note that the Macro group represents primarily (a) Discretionary Macro and (b) Managed Futures; the number of eligible funds in GTAA, Systematic Macro, Fixed Income Relative Value and Foreign Exchange sub-strategies were fewer than five each; as such, the results presented here are not meant to be representative of those sub-strategies. Source: PGIM IAS, eVestment. For illustrative purposes only.

95% CVaR and Performance

- We consider the average return and volatility values associated with each quartile of 95% CVaR
- It is surprising to find that the returns do not necessarily improve as the tail risk (represented by 95% CVaR) declines
- Volatility does generally decline with decreasing tail risk (Q4 of CVaR)

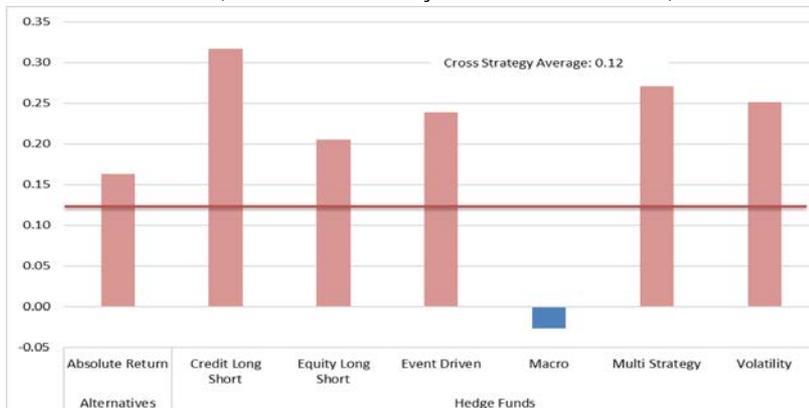


Note : USD returns, January 2008 – December 2016. We rank all funds by their 95% CVaR, in ascending order, and then take performance averages in each quartile. The top quartile has funds with least negative 95% CVaR and the bottom quartile has funds with most negative 95% CVaR. Returns and volatility are annualized averages. Please note that the Macro group represents primarily (a) Discretionary Macro and (b) Managed Futures; the number of eligible funds in GTAA, Systematic Macro, Fixed Income Relative Value and Foreign Exchange sub-strategies were fewer than five each; as such, the results presented here are not meant to be representative of those sub-strategies. Source: PGIM IAS, eVestment. For illustrative purposes only. Past performance is not a guarantee or a reliable indicator of future results.

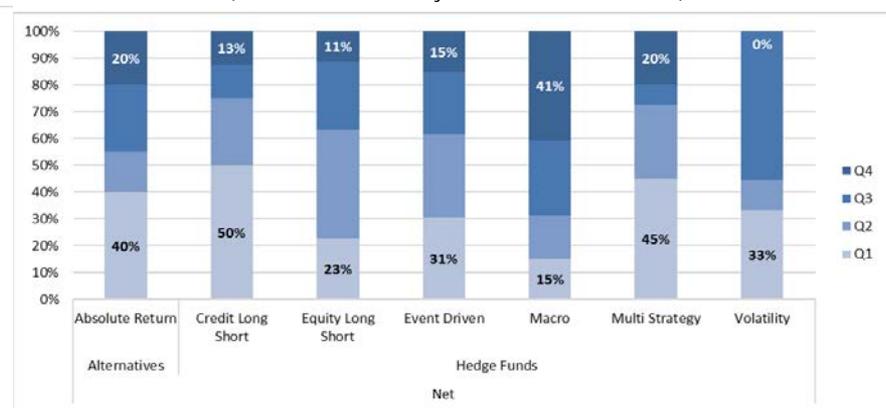
Downside Diversification

- We measure whether diversification holds up over weak markets
 - Downside equity correlation measure – correlation to equity markets during periods when equity returns are lower than one-half standard deviation from the sample mean
- Most of the strategies analyzed, except for Credit Long Short, exhibited relatively low (less than 0.30) downside correlation to equity market returns
- Macro had negative downside correlation to equities but greater tail risk (CVaR), more negative outcomes tended not to manifest during equity down markets

Average Anchor Ratio
(USD returns, January 2008 – December 2016)



Percentage of Funds in each Downside Correlation Quartile
(USD returns, January 2008 – December 2016)



Note: We determine the average equity downside correlation at the strategy level by calculating the equal-weighted average of the equity downside correlation for all funds in that strategy. The equity downside correlation is calculated as the correlation with US equity returns when equity returns were lower than one-half standard deviation from the sample mean. The average downside equity correlation of all funds analyzed was 0.12. The strategy with an average downside equity correlation that was lower than the overall average is in blue (Macro), and others are in red. Please note that the Macro group represents primarily (a) Discretionary Macro and (b) Managed Futures; the number of eligible funds in GTAA, Systematic Macro, Fixed Income Relative Value and Foreign Exchange sub-strategies were fewer than five each; as such, the results presented here are not meant to be representative of those sub-strategies. Source: PGIM IAS, eVestment. For illustrative purposes only.

Other Dependencies

- No particular trend in average return or volatility values associated with each quartile of downside correlation
- When sorting strategies by Anchor ratio quartiles, we found no discernible pattern in the associated averages for CVaR or for downside correlation
- Similarly, when sorting by CVaR quartiles or by downside correlation quartiles, no patterns were found in the other two measures
- This reinforces their value as distinct measures that may be used in concert in the evaluation process
- While the results presented here can serve as a guide to help investors understand how different strategies might broadly fit relative to objectives, the importance of understanding a *specific* manager's characteristics cannot be overemphasized
 - Manager-level results can then be compared to help determine which manager might be more likely to help fulfill a particular objective

Conclusions

- Investors seeking sustained positive returns, Credit Long Short and Event Driven strong potential candidates, Absolute Return, Multi Strategy, and Volatility strategies show promise as well
- Absolute Return, Event Driven, Credit Long Short, and Equity Long Short strategies all delivered strong results from a risk-adjusted return perspective, as measured by Sharpe ratio
- Investors focused on tail risk control may look to Event Driven strategies, Multi Strategy, Absolute Return, and Discretionary Macro, all of which had favorable average tail risk profiles
- Managed Futures, within Macro, were attractive from an equity downside diversification perspective, didn't fare as well for sustainability or tail risk control

Objective:	Performance Sustainability	Lower Tail Risk	Downside Diversification	Risk-Adjusted Return
Measure:	Anchor Ratio	95% CVaR	Downside Equity Correlation	Sharpe Ratio
Absolute Return	X	X		X
Multi Strategy	X	X		
Event Driven	X	X		X
Volatility	X			
Credit Long Short	X			X
Equity Long Short				X
Macro*				
Discretionary Macro		X		
Managed Futures			X	

Note: An "x" indicates relatively favorable results for the given strategy when evaluated based on the given measure. In each case, an "x" is marked if (a) the strategy-level average of that measure was greater than the overall average of that measure (of all funds evaluated across strategies) and (b) if more than 30% of the individual funds evaluated in that strategy were associated with top quartile results of the given measure. Quartile results for the Sharpe ratio measure, not presented in the paper, are available upon request.

*Macro results are presented at the sub-strategy level here for (a) Discretionary Macro and (b) Managed Futures, given the relatively large number of funds and unique characteristics in each of these categories. The number of eligible funds in GTAA, Systematic Macro, Fixed Income Relative Value and Foreign Exchange sub-strategies were fewer than five each, and therefore were not reported at the sub-strategy level, and overall "Macro" strategy-level results are not meant to represent the characteristics of these sub-strategies.

Source: PGIM IAS, eVestment. For illustrative purposes only.

Appendix: Performance Metrics Definitions

- **Hit Rate (also known as Batting Average)** – As the name would imply, hit rate is a measure of the frequency of success. This ratio is calculated by taking the number of periods where the manager equals or outperforms the selected benchmark, divided by the total number of periods. This measure indicates a manager's frequency of success, without regard to degree of outperformance.

$$\text{Hit Rate} = \frac{\text{number of positive observations}}{\text{total number of observations}}$$

- **Sharpe Ratio** – This statistic is computed by subtracting the return of the risk-free index (typically 91-day T-bill or some other cash benchmark) from the return of the manager to determine the risk-adjusted excess return. This excess return is then divided by the standard deviation of the manager.
- **Sortino Ratio** – This measure is similar to the Sharpe ratio except that it is concerned only with downside volatility (unfavorable) versus total volatility (both favorable, upside volatility and unfavorable, downward volatility). This statistic is computed by subtracting the return of the risk-free index (typically 91-day T-bill or other cash index) from the return of the manager to determine the risk-adjusted excess return. This excess return is then divided by the downside risk of the manager.
- **Downside Volatility** – Downside risk (also known as downside deviation) attempts to further break down volatility between upside volatility – which is generally favorable since it implies positive outperformance – and downside volatility – which is generally unfavorable and implies loss of capital or returns below an expected or required level.
- **Max Drawdown** – The maximum of the peak-to-trough declines during a specific period. Going sequentially through time with a manager's cumulative return, it is the "loss" from the highest portfolio value to its lowest point. This is a commonly used hedge fund measure since such funds often employ hedging strategies to protect returns in down markets; hence, the max drawdown is expected to be low.
- **Downside Correlation** – Correlation of a manager performance to the benchmark or market when the benchmark is lower than a threshold percentage on the downside. In this paper, we use one standard deviation as the threshold.
- **p% VaR** - p% VaR (Value at Risk) is defined as a value of loss, for a given investment horizon, when the probability of loss is less than or equal to (1-p)%.
- **p% CVaR** – Conditional Value at Risk (CVaR) is the average of all losses greater or equal than Value at Risk (VaR), also known as Expected Shortfall, the average loss in the worst (1-p)% cases, where p is the confidence level.

Appendix: Fund Screening

- Several screens were applied which left us with 300 funds
- First, screened for funds that allowed for monthly, or more frequent, redemption
- ETFs and funds reported gross of fees were excluded.
- We further screened the results for geographic focus (focusing on Global, ACWI, North America or United States), full history (2008-2016, inclusive) and diversification to traditional assets (less than 0.5 beta, in absolute value terms, to S&P 500 Composite Index, MSCI All Country World Index, Barclays US Aggregate Bond Index and to Barclays Global Aggregate Bond Index)

Asset Class	Strategy	Liquid (net, non-ETF)	Geographic Focus	Full History	Beta < 0.5
Alternatives		303	237	47	24
	Absolute Return	287	225	42	20
	Currency	16	12	5	4
Hedge Funds		1,967	1427	514	276
	Commodities	75	74	25	5
	Credit Long Short	143	86	12	8
	Equity Long Short	846	469	160	79
	Event Driven	82	71	23	13
	Insurance	13	13	4	4
	Macro	504	463	210	118
	Multi Strategy	228	183	66	40
	Niche	21	15	1	0
	Volatility	55	53	13	9
Total		2,270	1,664	561	300

Note: The Credit Long Short and Volatility strategies comprise relatively few funds; readers should be cautious when extending the conclusions associated with those strategies to other funds. Source: PGIM IAS, eVestment, as of 12/31/2016. For illustrative purposes only.

Appendix: Anchor Ratio vs. Sharpe Ratio Persistence

- Strategies are organized into quartiles according to their rank based on the given measure over the first half of the period studied (4.5 years, from Jan. 2008 - Jun. 2012)
- And then again according to their rank based on that same measure over the second half of the period studied (4.5 years, from Jul. 2012 - Dec. 2016)
- The percentages represent the likelihood of moving from a given quartile in the first subsample to a given quartile in the second subsample
- With Q4 → Q4 transition probability at 45%, the Anchor ratio demonstrates notably higher persistence than the Sharpe ratio does (at 32%)

Anchor Ratio Persistence

		Subsequent Period (54 months)			
		Q1	Q2	Q3	Q4
Prior Period (54 months)	Q1 (Low)	33%	39%	20%	8%
	Q2	25%	33%	23%	19%
	Q3	20%	21%	31%	28%
	Q4 (High)	21%	7%	27%	45%

Sharpe Ratio Persistence

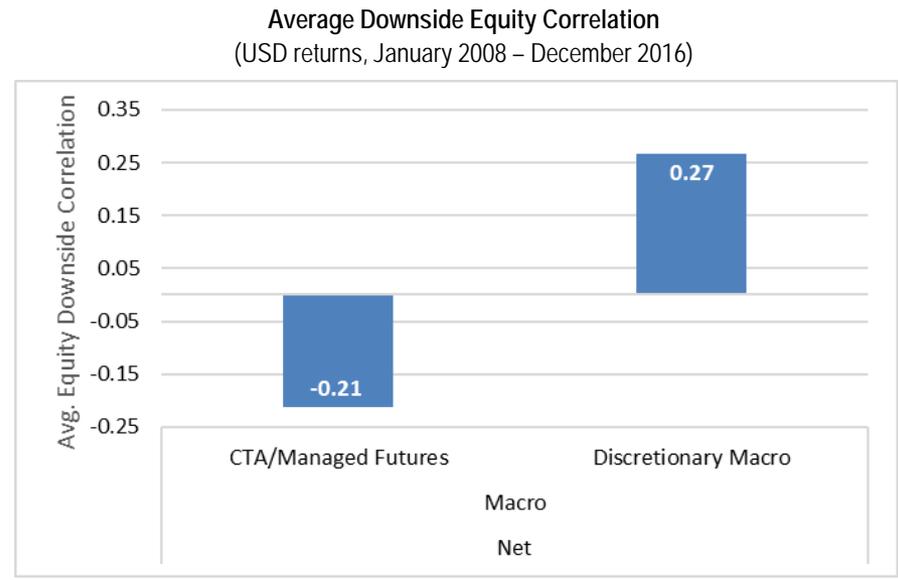
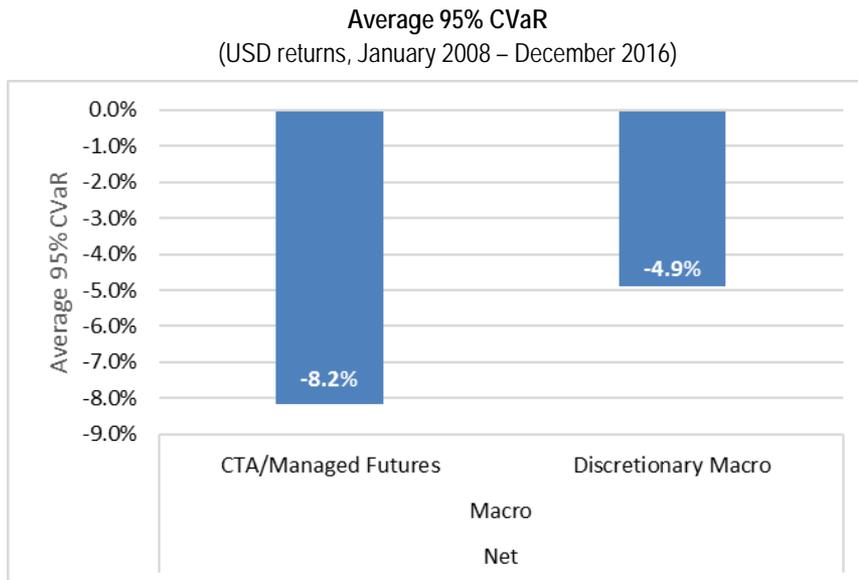
		Subsequent Period (54 months)			
		Q1	Q2	Q3	Q4
Prior Period (54 months)	Q1 (Low)	31%	21%	23%	25%
	Q2	28%	31%	24%	17%
	Q3	20%	31%	24%	25%
	Q4 (High)	21%	17%	29%	32%

Note: The values in the matrices above represent the percentage of funds transitioning from one quartile to another quartile in two consecutive periods. For example, in the left exhibit, the {Q4, Q2} value of 7% means that 7% of the funds classified as Q4 (high Anchor ratio) in the first period were subsequently classified as Q2 (mid-low Anchor ratio) in the next period. A high {Q4, Q4} transition percentage implies that funds with a high ratio in the past are likely to maintain a high ratio in the future; here we find the Anchor ratio measure to have a higher persistence than the Sharpe ratio measure.

Source: PGIM IAS, eVestment. For illustrative purposes only. Past performance is not a guarantee or a reliable indicator of future results.

Appendix: Macro Sub-Strategy Analysis

- Macro sub-strategies had different outcomes,
 - the CTA/Managed Futures strategies had negative downside equity correlation (countercyclical performance), where as Discretionary Macro strategies had lower tail risk
 - 31% of Discretionary Macro and 60% of CTA funds were in the top quartile (low) when sorted by 95% CVaR and downside equity correlation respectively

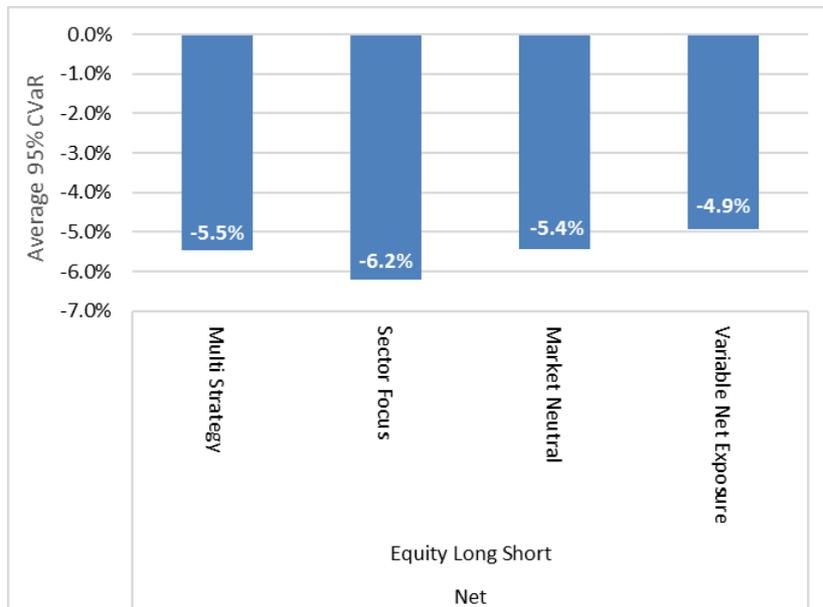


Note: The Macro strategy group, which had 118 funds after screening, includes two main sub-strategies (# of funds): CTA/Managed Futures (55) and Discretionary Macro (45) Commodity Trading Advisors. Source: PGIM IAS, eVestment. For illustrative purposes only.

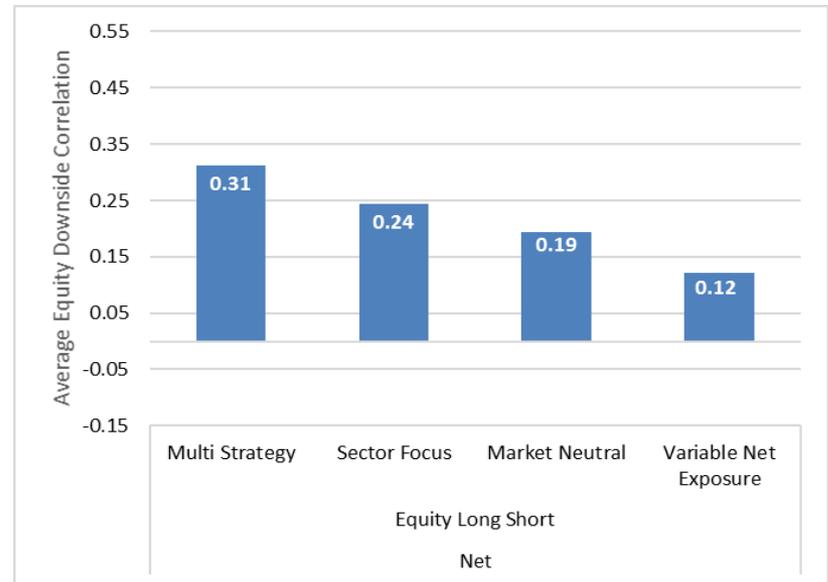
Appendix: Equity Sub-Strategy Analysis

- Some of equity sub-strategies had different outcomes,
 - Variable Net Exposure sub-strategy not only had lower tail risk but also lowest downside equity correlations
- Sector focus fund had higher than average Anchor ratio (2.08) and 33% of funds were in the top quartile (high) when sorted by Anchor ratio

Average 95% CVaR
(USD returns, January 2008 – December 2016)



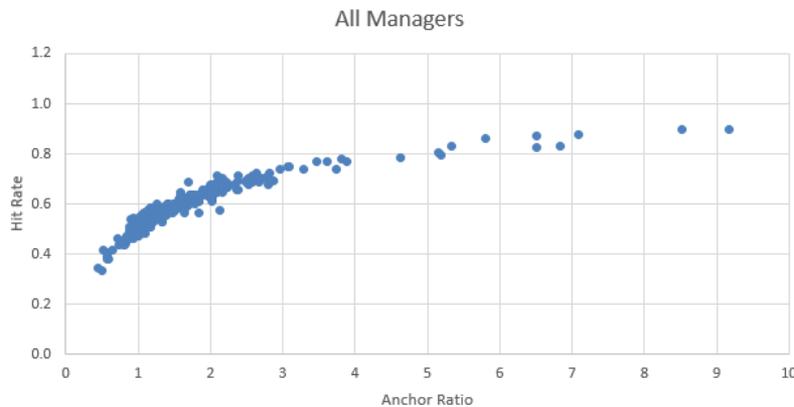
Average Downside Equity Correlation
(USD returns, January 2008 – December 2016)



Note: The Equity Long Short strategy group, which had 79 funds after screening, includes four sub-strategies (# of funds): Multi Strategy (13), Sector Focus (15), Market Neutral (23) and Variable Net Exposure (26). Source: PGIM IAS, eVestment. For illustrative purposes only.

Appendix: Comparing Hit Rate to Anchor Ratio

- It is not surprising to see hit rate and Anchor ratio are similar
 - but as we see in the scatter plot for all managers there is non-linearity in Anchor ratio
 - Of course, this is by the very definition of AR but while hit rate plateaus AR is increasing
 - In the cross-section if we try and explain the 10-year total returns for all managers, they are really being explained by the hit rate
- For managers in top quartile, sorted by their 10-year total returns for the entire period, same non-linear pattern, lot of the higher AR occurrences are really for these superior managers
 - The 10-year total returns for the superior managers are really being explained by the Anchor ratio and the indicator variable for AR greater than two



	I(AR>2)	Hit Rate	AR	Intercept
Slope	0.01	0.24	0.00	-0.10
Std. Error	0.01	0.05	0.00	0.02
T-Stat	0.71	5.33	-2.05	-4.15
R-Squared	0.21			



	I(AR>2)	Hit Rate	AR	Intercept
Slope	0.03	-0.25	0.02	0.21
Std. Error	0.01	0.13	0.01	0.07
T-Stat	2.25	-1.93	2.33	3.13
R-Squared	0.19			

Note: USD returns, January 2008 – December 2016 Source: PGIM IAS, eVestment. For illustrative purposes only.

Appendix: Comparing Hit Rate to Anchor Ratio

- For robustness, we tried several performance metrics to explain cross section of manager 10-year total returns including - Anchor ratio, $\log(\text{AR})$, hit rate, 95% VaR, 95% CVaR, Maximum Drawdown, Correlation (to Equities), three Downside Correlation measures (when equities are negative, lower than half standard deviation and one standard deviation), indicator variable when AR is greater than two, general consistency measure (Villaverde (2010)), serial correlation (AR(1)), maximum duration of negative returns, maximum duration of positive returns, hit runs ratio and miss runs ratio
- Using Lasso regularization (with reasonable choice of positive regularization parameter), we evaluate which of these variables explain cross-section of manager total returns for both all managers and superior managers
- We confirm similar relevance of AR over hit rate for superior managers

Beta (Lasso Regularization)

	AR	Hit runs ratio	Miss runs ratio	Hit Rate	95%VaR	95%CVaR	Maximum Drawdown	Downside Equity Correl (<0.5 Std Dev.)	Downside Equity Correl (<1 Std Dev.)	I(AR>2)
All Managers			-0.212	0.134	-0.092			-0.016	-0.002	
Skilled Managers	0.003	0.017					0.034	-0.001		0.009

Note: USD returns, January 2008 – December 2016. Cross-sectional regression across fund managers. VaR are stated negative and maximum drawdowns are stated positive, so the coefficient signs look flipped. Sign of the betas suggest total returns in cross-section are explained by taking more VaR or maximum drawdown exposure. However, downside exposure to equities is still negatively compensated. See: Michael Villaverde, "Measuring investment performance consistency," *Quantitative Finance* 10, no. 6 (June 2010): 565-574, wherein the author proposes combining information ratio, maximum drawdown and maximum breakeven time capture the cumulative impact of consistent, or inconsistent, performance. Source: PGIM IAS, eVestment. For illustrative purposes only.

Appendix: Robustness Checks

- Because Anchor ratio is a path dependent measure, for robustness we also evaluated the period from 1999-2007, using the same fund screening methodology
 - Some of the more notable comparisons between the two periods include:
 - (a) Eight of the 28 credit long/short funds (about 30%) were in the top Anchor ratio quartile over 1999-2007, compared to 88% in the top quartile over 2008-2016; however, only 8 credit long/short funds were eligible for analysis from 2008-2016, which likely had a significant impact on results
 - (b) 17% of Macro funds were in the top Anchor ratio quartile over 1999-2007, compared to 8% over 2008-2016, resulting in less than a 25% representation in the top quartile over either period
 - (c) Over 1999-2007, the top quartile for Anchor ratio was dominated by the Event driven, Multi-strategy and Volatility strategies, each with about 50% of its funds in the top quartile
- The risk-adjusted performance based strategy ranking were similar when Sortino ratio was used instead of Sharpe ratio, however, there are fund level rank differences
- The performance consistency based strategy ranking were similar when hit rate was used instead of Anchor ratio, however, there are fund level rank differences
- Due to the shorter time periods used in persistence analysis, we checked for robustness by conducting the same analysis for the nine-year period from 1999-2007
 - Over this earlier time period, we found that the Q4 → Q4 transition probabilities for the Anchor ratio and Sharpe ratio were in fact the same, at 39%

Modified Anchor Ratio

- In order to understand performance sustainability, we can fit the hit runs to Weibull distribution. x is score of hit runs. We separately fit for miss runs.

$$f(x) = \frac{\beta}{\alpha} \left(\frac{x - \mu}{\alpha}\right)^{\beta-1} \exp\left(-\left(\frac{x - \mu}{\alpha}\right)^\beta\right) \text{ for } x \geq \mu; \beta, \alpha > 0$$

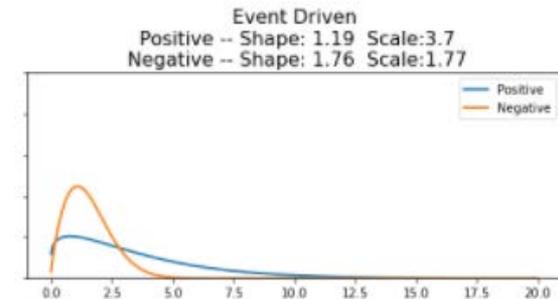
- Where β is the shape parameter, μ is the location parameter and α is the scale parameter of the distribution
- We can calculate the probability for the strategy or an individual manager to have greater than j -months of hit run score

$$P(> j \text{ hit run score}) = \exp\left(-\left(\frac{j}{\alpha_p}\right)^{\beta_p}\right)$$

- Where j is the score of hit runs, α_p is the scale parameter and β_p is the shape parameter of Weibull distribution fitted by hit run scores

Modified Anchor ratio

$$= P(> j \text{ hit run score}) \div P(> k \text{ miss run score})$$



Refer to Thomas K. Philips, Emmanuel Yashchin, and David M. Stein, "Using Statistical Process Control to Monitor Active Managers," *Journal of Portfolio Management* 30, no. 1 (Fall 2003): 86-94

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