Quantitative Assessment of MS Fund

A quantitative return based analysis of the MS Fund against a large Multi Strategy hedge fund peer revealed the following characteristics:

- The portfolio has posted positive returns since inception, with the exception of 2008.
- The annual standard deviation belongs to the top quartile of the Multi Strategy peer group since the beginning of 2012 compared to its peers.
- The tail risk belongs to the top 25% in its Multi Strategy hedge fund peer group since the beginning of 2014.
- The Calmar ratio, Sharpe ratio as well as VaR risk measure belong to top 25% of the Multi Strategy hedge fund peer group.
- In three out of four years the simulation predicts an annualized return of 7% or higher.
- In one out of twenty years the simulation predicts that the maximum drawdown will exceed 9%.

Conclusion:

The analysis shows that the fund belongs to the top quartile on a cumulated performance compared to the Multi Strategy hedge fund universe. Furthermore, the fund belongs to the top performer of his Multi Strategy hedge fund peer group when it comes to risk-adjusted returns. We see that the return distribution for the last couple of months is similar to a normal distribution. This means, that the fund should not have large outliers in his monthly returns. Moreover, the portfolio generates relatively high earnings for a fair to low amount of risk compared to his Multi Strategy hedge fund peer.
From a quantitative perspective we recommend the fund for investment as long as the fund fits into the portfolio.

Authors:

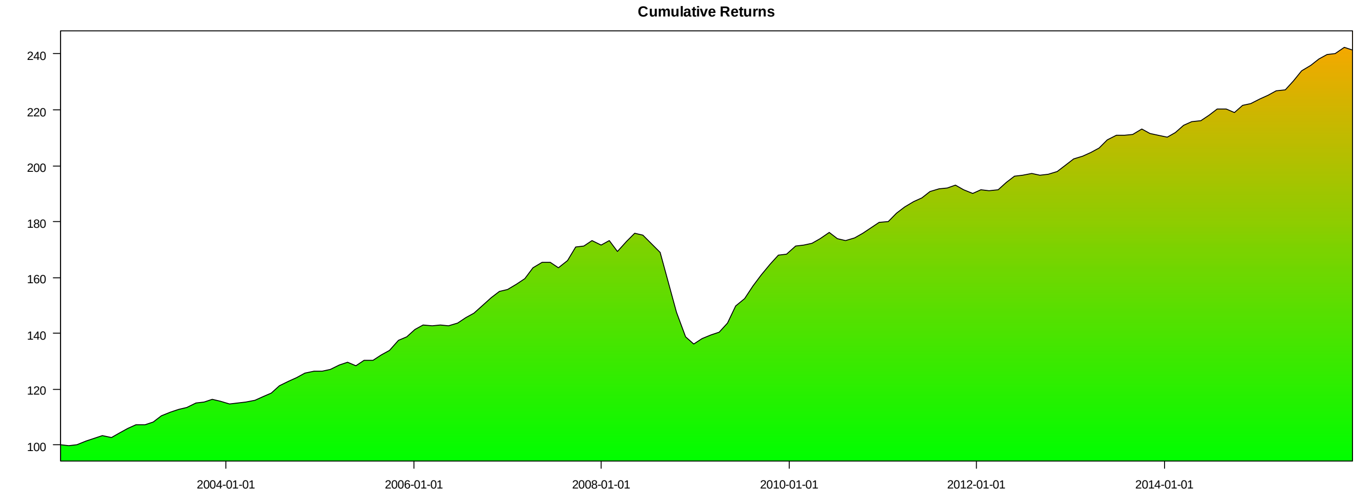
Patrick Dütsch / Jann Stoz

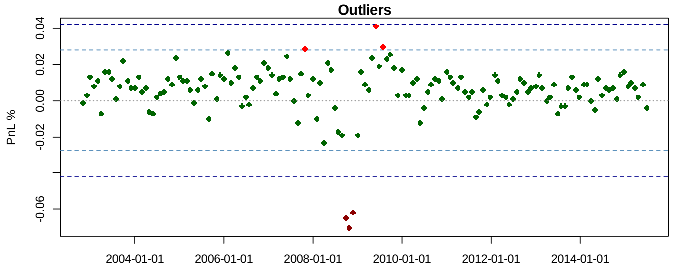
duet@zhaw.ch / stoz@zhaw.ch

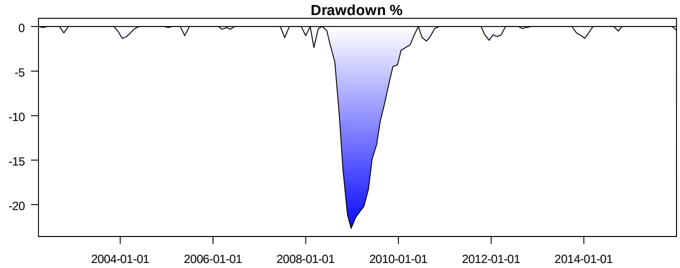
Quantitative Analysis: MS Fund

This report provides a return based analysis of the MS Fund (fund). With a holistic approach the fund is compared to a large Multi Strategy hedge fund peer. In fact, the peer consists of approximately 350 funds. This report does not take any traditional indices such as MSCI World or Barclays into account because of the comparison to the large Multi Strategy peer group. The analyzed data ranges from October 31, 2002 (inception) to June 30, 2015. The analysis is based on monthly returns.

Return Structure







From September to November 2008 (financial crisis) the fund faced his largest losses. The dashed lines in the outlier analysis represent the two and three sigma (standard deviation) range in percent. During the financial crisis the fund had three extraordinary negative months. According to an normal distribution such a cluster of negative months should almost never happen. The same holds true for his positive months in October 2007, and in May and July 2009.

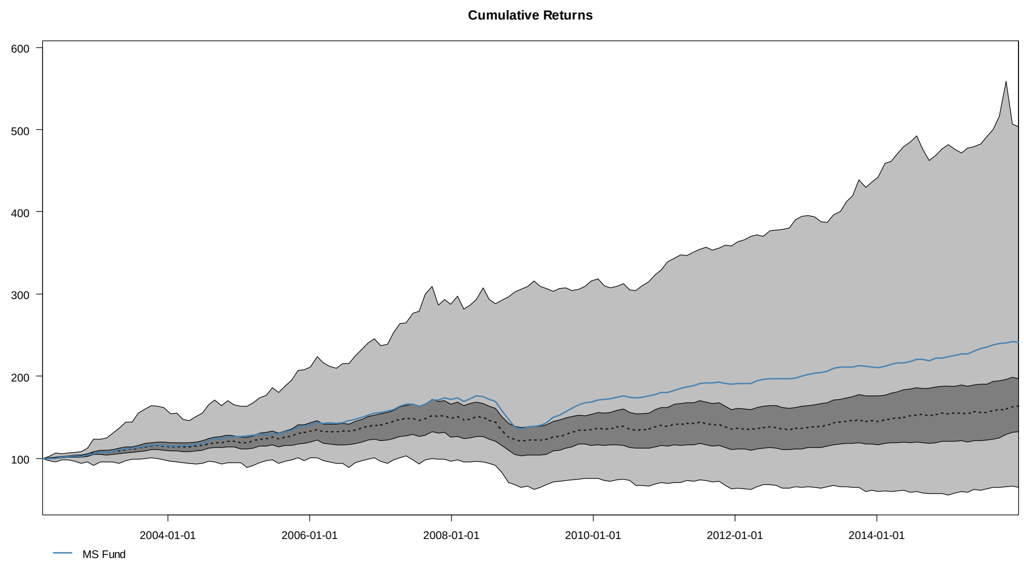
Monthly Performance and Fund Statistics

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD
2002										-0.10%	0.30%	1.30%	1.50%
2003	0.80%	1.10%	-0.70%	1.60%	1.60%	1.20%	0.10%	0.80%	2.20%	1.10%	0.70%	0.70%	11.50%
2004	1.30%	0.50%	0.70%	-0.60%	-0.70%	0.20%	0.40%	0.50%	1.20%	0.90%	2.40%	1.30%	8.40%
2005	1.10%	1.10%	0.60%	-0.10%	0.60%	1.20%	0.80%	-1.00%	1.50%	0.10%	1.40%	1.20%	8.80%
2006	2.70%	1.00%	1.80%	1.30%	-0.30%	0.20%	-0.20%	0.70%	1.30%	1.10%	2.10%	1.80%	14.30%
2007	1.40%	0.40%	1.20%	1.30%	2.50%	1.20%	0.00%	-1.20%	1.50%	2.90%	0.30%	1.20%	13.50%
2008	-1.00%	1.00%	-2.30%	2.10%	1.70%	-0.40%	-1.70%	-1.90%	-6.30%	-6.80%	-6.00%	-1.90%	-21.60%
2009	1.60%	0.90%	0.60%	2.40%	4.20%	1.90%	3.00%	2.30%	2.60%	1.80%	0.30%	1.70%	25.70%
2010	0.30%	0.30%	1.00%	1.20%	-1.20%	-0.40%	0.50%	0.90%	1.20%	1.10%	0.10%	1.60%	6.90%
2011	1.30%	1.00%	0.70%	1.30%	0.50%	0.20%	0.50%	-0.90%	-0.60%	0.60%	-0.20%	0.20%	4.60%
2012	1.40%	1.10%	0.30%	0.20%	-0.20%	0.10%	0.50%	1.20%	1.00%	0.50%	0.70%	0.80%	7.80%
2013	1.40%	0.70%	0.00%	0.20%	0.90%	-0.70%	-0.30%	-0.30%	0.70%	1.30%	0.60%	0.20%	4.70%
2014	0.90%	0.90%	0.00%	-0.50%	1.20%	0.30%	0.70%	0.60%	0.70%	0.10%	1.40%	1.60%	8.20%
2015	0.80%	1.00%	0.70%	0.20%	0.90%	-0.40%							3.30%

	MS Fund	Median Peer Fund
Ann. Return	7.01%	5.08%
Ann. Standard Dev.	4.84%	4.64%
Skewness s.l.	-2.57	-1.85
Kurtosis s.l.	11.78	6.69
Calmar Ratio	0.30	0.26
Ann. Sharpe Ratio	1.44	1.09
Value at Risk 95%	-2.23%	-2.21%
Largest Drawdown	-23.22%	-19.39%
Worst Month	-6.80%	-6.57%
Best Month	4.11%	3.14%
Avg. Positive Month	1.03%	1.01%
Avg. Negative Month	-1.36%	-1.24%
Correlation to Median Peer Fund	0.87	-

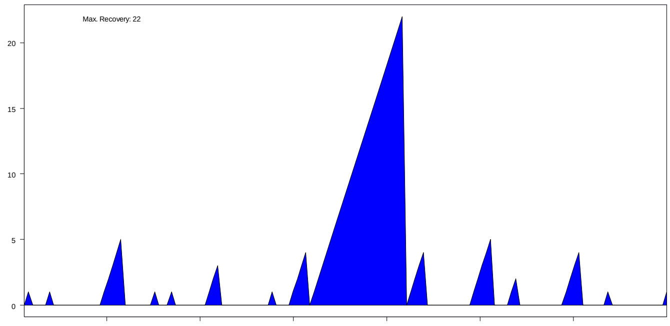
When the fund is compared to a median peer fund (median return over the Multi Strategy hedge fund peer group) over the period (2002-2015) the annualized return is 2% higher with a slightly higher standard deviation. Skewness und kurtosis are almost twice as large compared to the median peer group fund. These risk measures imply that the fund is left skewed (negative returns) as well as fat tailed (positive kurtosis). However, those high risk measures result mainly from the clustered outliers in the financial crisis. From a risk-return perspective the fund is clearly located above its Multi Strategy hedge fund peer group. This means that the fund provides relatively high earnings for a fair to low amount of risk compared to his peer.

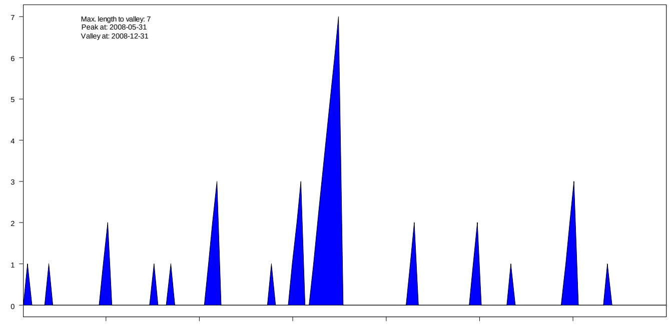
Cumulated Returns:



This graph shows the cumulated performance of the fund compared to the Multi Strategy peer group. The dashed line represents the median cumulated performance. The dark gray area represents 50% of the peer group funds and the light gray area above and below the top (worst) performing funds. The fund (blue line) clearly belongs to the top performers. The fund belongs to the top 25% of the peer group since his inception.

Recovery and Valley



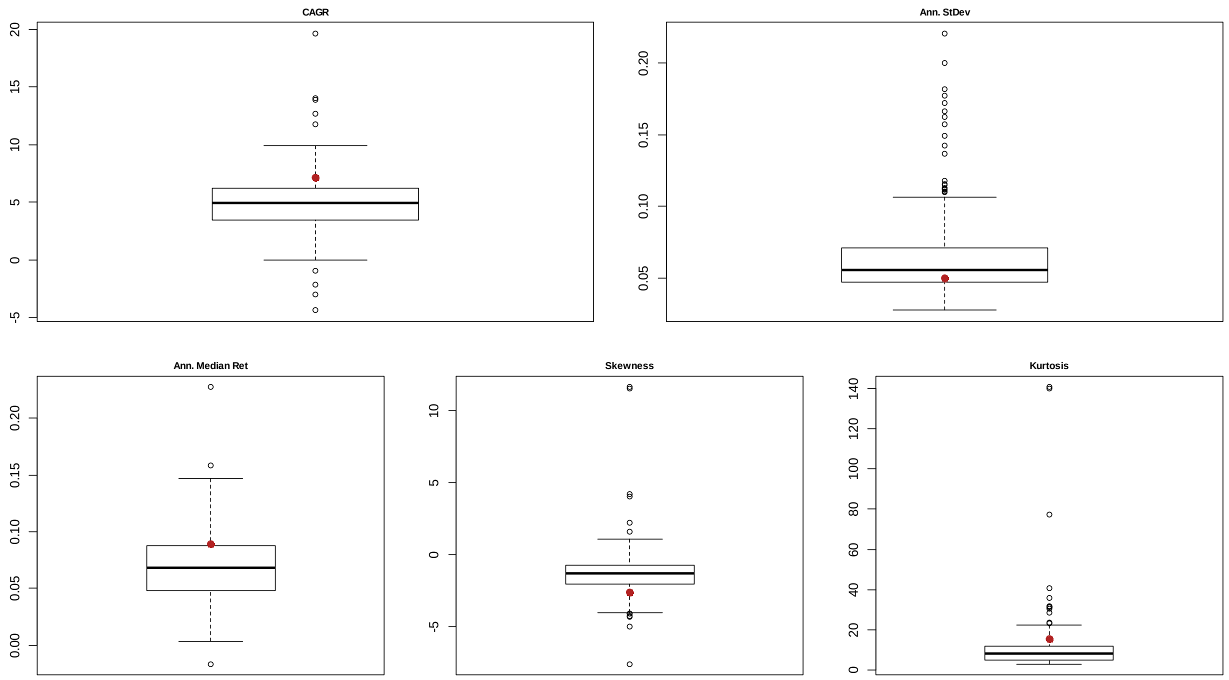


The maximum recovery time from the beginning to the end of the maximum drawdown lasted 22 months (financial crisis and its aftermath). Usually the fund has a recovery period of four to six months. The valley chart shows the number of month to get to the valley (i.e. deepest point of the drawdown). For example, it took the fund seven months to get to the maximum drawdown in 2008 and then 15 months later he recovered to his previous high.

Statistical Moment Analysis

The statistical analysis shows that with a 7.11% compounded annual growth rate (CAGR) the fund (red dot) belongs to the top quartile. From an annual median return perspective, the fund outperforms more than 75% of his peer. The standard deviation belongs to the lowest 50% of the peer group which is positive.

The fund exhibits fat tails as can be seen with the kurtosis. The returns are left skewed (negative skewness) which comes mainly form the three outliers in 2008.

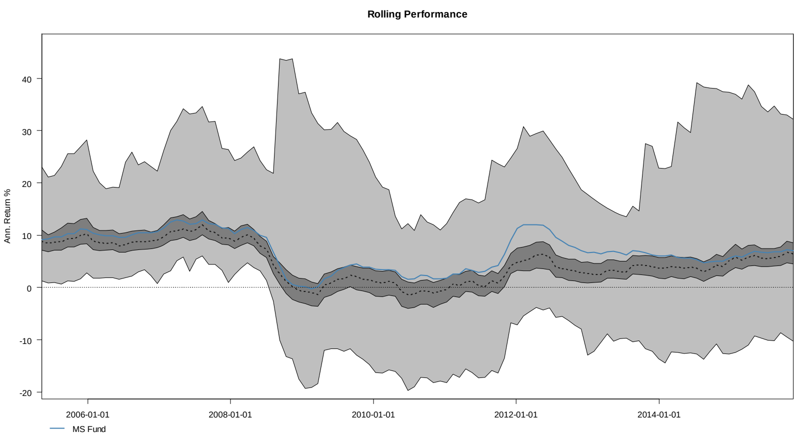


The analysis includes all funds with returns before and during the financial crisis of 2008.

Rolling Boxplots:

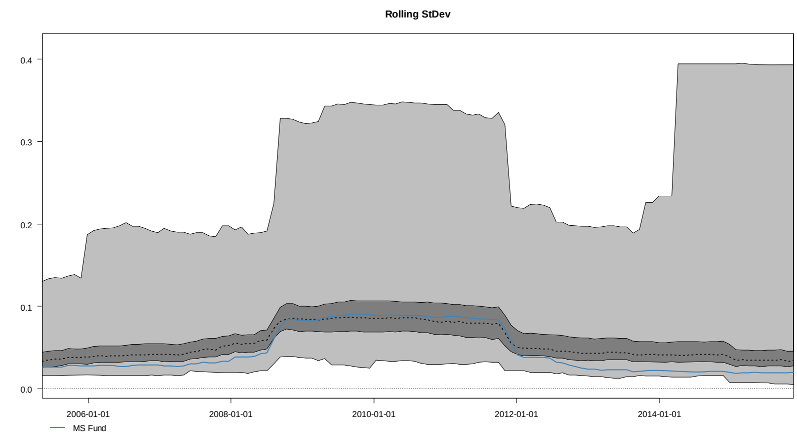
In this section the authors look at a cross-sectional analysis over time. The different risk measures are calculated for each fund in the Multi Strategy peer group as well as for the fund under inspection. The risk measures are calculated over a time window of 36 months. For each time window the quartiles are calculated. This means the group of funds are categorized into quartiles. The median fund is represented by the dashed line. A middle range of 50% is represented within the dark gray area and the top and worst 25% of the peer group are represented by the light gray areas. The fund is shown as blue line.

Rolling CAGR 36mth:



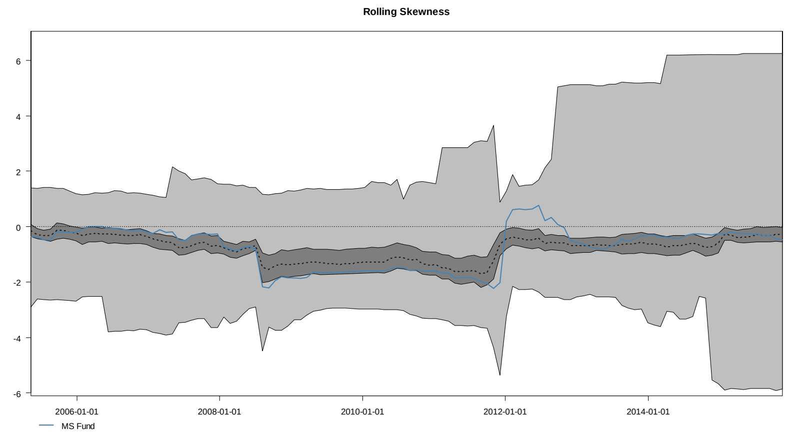
The rolling CAGR on a 36 month window shows that the fund belongs to the best 50 to 25% of its peers. Since 2014 the fund got back into the 50% of the peers and close to the peer group median. Most of the universe had a slight upward trend whereas the fund remained flat.

Rolling annualized Standard Deviation 36mth:



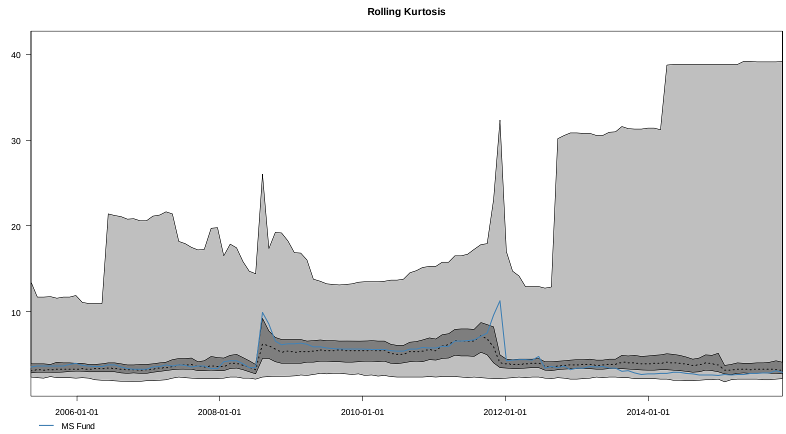
On an annualized standard deviation based over 36 months the fund belongs to the top 25% of the peer group. In fact, only during the period January 2009 to December 2012 the fund had a higher standard deviation than the peer group median.

Rolling Skewness 36mth:



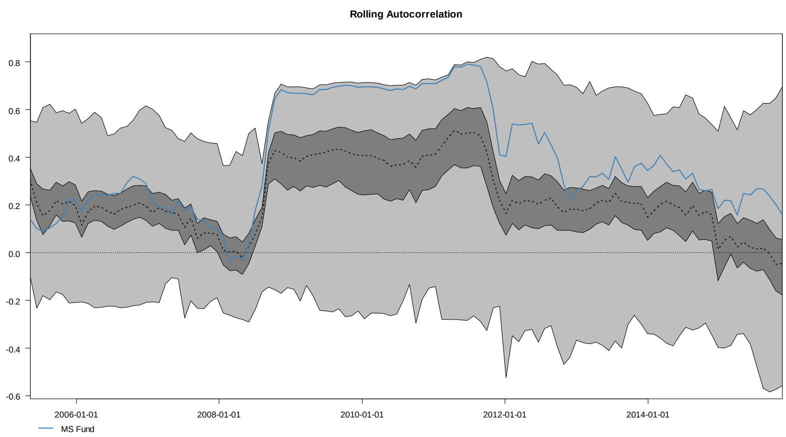
With the exception of a couple of months in 2012, the fund has been left skewed (sensitive to losses) for his entire period, albeit the median peer group fund exhibits also a small negative skewness. For the last couple of months the skewness of the fund is close to zero. This highlights the fact that the return distribution is close to a normal distribution.

Rolling Kurtosis 36mth:



The figure shows the clear impact of the financial crisis. Compared to his peer group the fund has generally a median to low 36 months kurtosis. The fund had average fat tails compared to his peer in the crisis. Since the end of 2013 the kurtosis decreased and the fund belongs to the top quartile of his peer group since the beginning of 2014.

Rolling Autocorrelation 36mth:

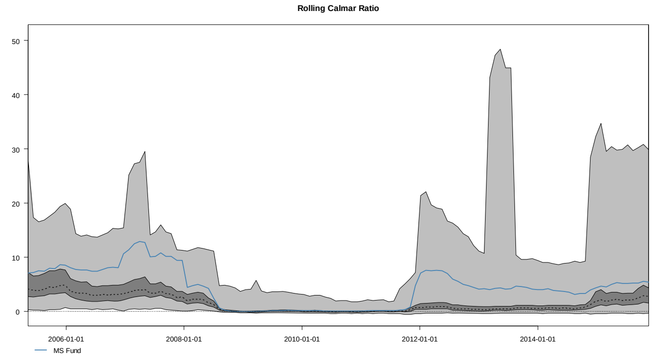


In financial literature high first lag autocorrelation can be seen as a sort of smoothing the returns as well as a sign for illiquidity. The fund has a rather high autocorrelation during the crisis. For the period after the crisis, the fund still belongs to the higher 25%. Nevertheless, an autocorrelation of 0.2 for June 2015 is neither a strong evidence for illiquidity nor return smoothing.

Risk / Return Measures

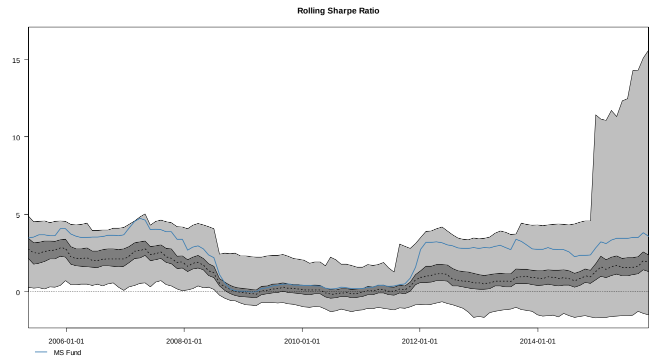
The risk-return measures are calculated on a 36 months basis. The graphs show with the dashed line the peer group median, dark gray represents 50% of the peers, light gray represents the top 25% (worst 25%) of the peer group. The fund is shown with the blue line.

Calmar Ratio rolling 36mth:



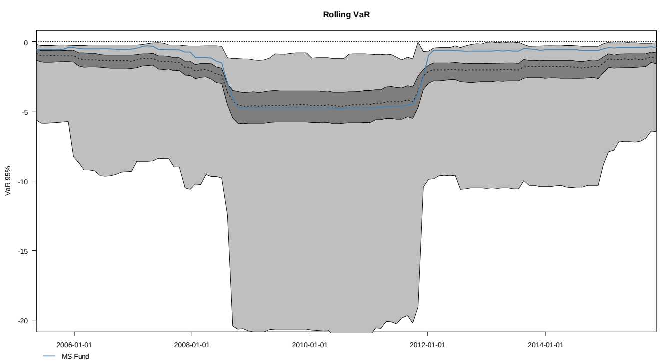
Since the financial crisis until June 2011 the fund as well as the entire peer group had a very low Calmar ratio. In fact, the higher the Calmar ratio, the better the investment performed on a risk-adjusted basis. The years before the financial crisis and after 2011 the fund belonged to the top 25% performer of his peer group.

Sharpe Ratio rolling 36mth:



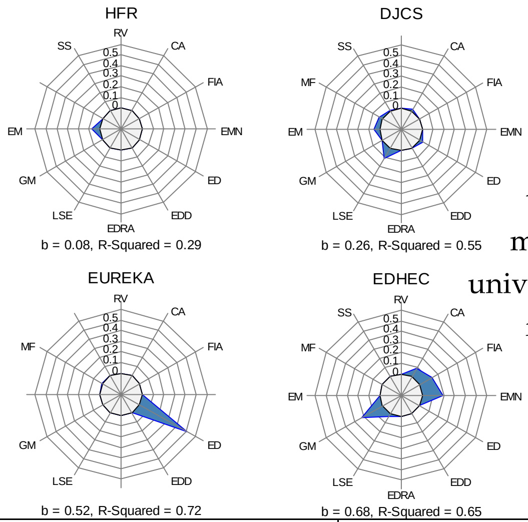
The rolling Sharpe ratio, shows a similar pattern as the above Calmar ratio. The fund belongs to the top quartile of its peers before the crisis in 2008 and after 2011.

Value at Risk rolling 36mth:



The rolling 95% VaR of the fund has been very low before the crisis, increased and belonged to the median of the peer group for the time window of 2009 to 2012. Since 2012 the fund has again one of the lowest VaR in his peer group.

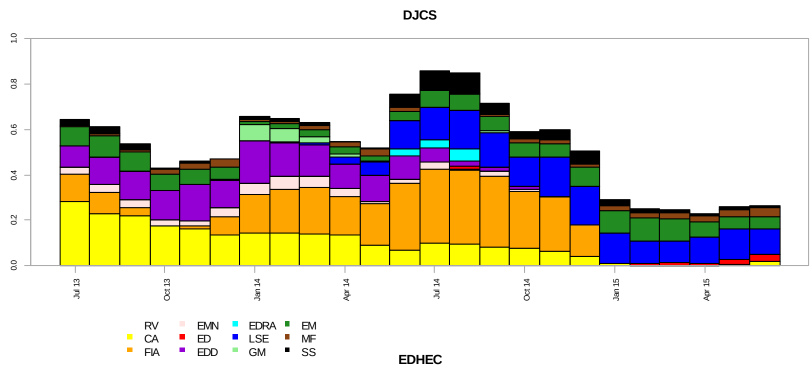
Hedge Fund Styleanalysis



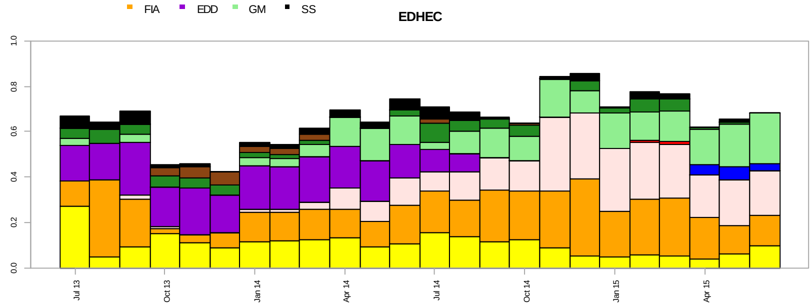
A return based style factor analysis for the fund as of June 2015 reveals different single hedge fund style exposures. Based on a 48 month return window the model finds different exposures for the four Hedge Fund Index providers. The model can explain more than 70% of the return variability (R^2) for the EUREKA universe and measures a clear Event Driven Multi Strategy exposure for the fund. In a EDHEC universe the model finds exposure to Global Macro, Equity Market Neutral, Fixed Income Arbitrage as well as Convertible Arbitrage.

RV: Relative Value	CA: Convertible Arbitrage	FIA: Fixed Income Arbitrage	EMN: Equity Market Neutral
ED: Event Driven Multi Strategy	EDD: Distressed Securities	EDRA: Merger Arbitrage	LSE: Long Short Equity
GM: Global Macro	EM: Emerging Markets	MF: Managed Futures	SS: Short Selling

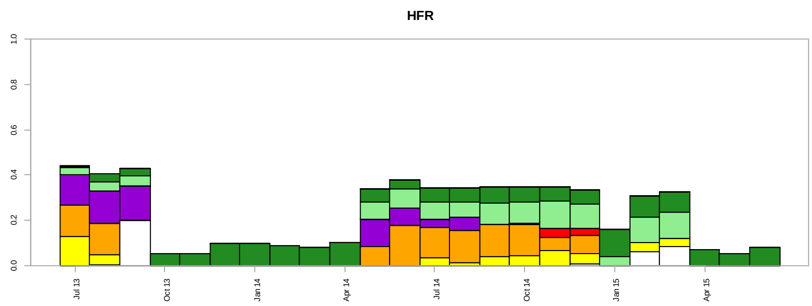
Hedge Fund Styles over Time:



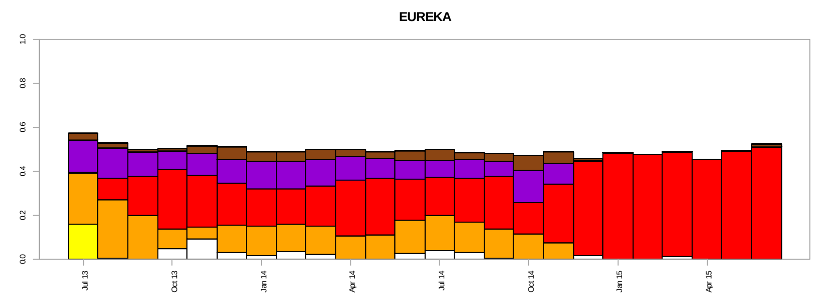
The main exposures for the Dow-Jones Credit Suisse index over time have been Convertible Arbitrage and Fixed Income Arbitrage. Since January the model mainly observes exposure to Long Short Equity and Emerging Markets.



In the EDHEC universe measures approximately the same exposures as DJCS. In addition, the model measures Equity Market Neutral as well as Global Macro exposure.



The HFR Universe measures only a marginal beta exposure for the observation period. Nevertheless, the regression model observes equivalent style exposures as the two indices above.

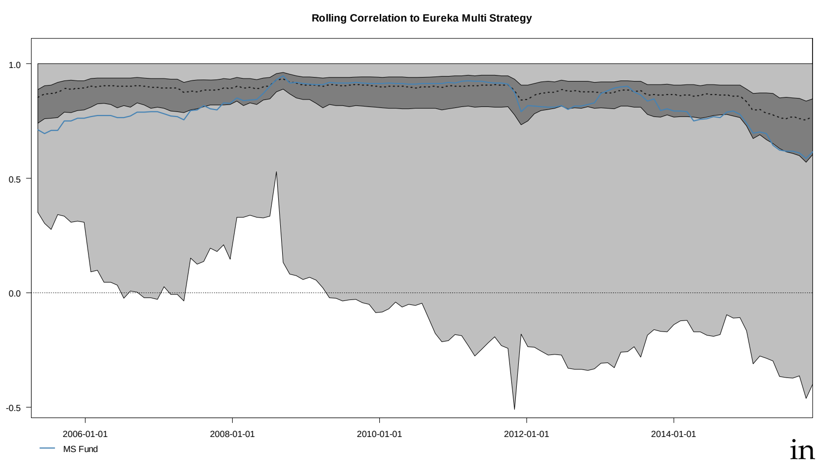


In contrast to the other hedge fund indices we cannot only observe a slightly different style exposure for the Eureka universe but also a higher R^2. The fund seems to be mainly driven Event Driven Multi Strategy and Long Short Equity as well as some FIA exposure.

Rolling Correlation to Eureka Hedge Event Driven Multi Strategy

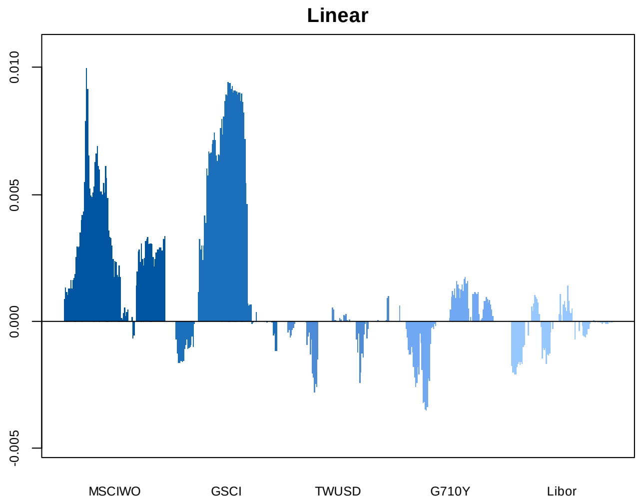
The style index analysis shows a rather high beta exposure to the Event Driven Multi Strategy hedge fund class. This means that the fund is sensitive towards movements of the universe of Event Driven Multi Strategy hedge funds. The rolling correlation plot below is calculated on a 36 months basis. The graph shows with the dashed line the median of the correlation of our multi manager peer group to the Eureka Hedge Event Driven Multi Strategy benchmark. The dark gray area represents 50% of the peers, light gray represents the top 25% (worst 25%) of the peer group. The fund is shown by the blue line.

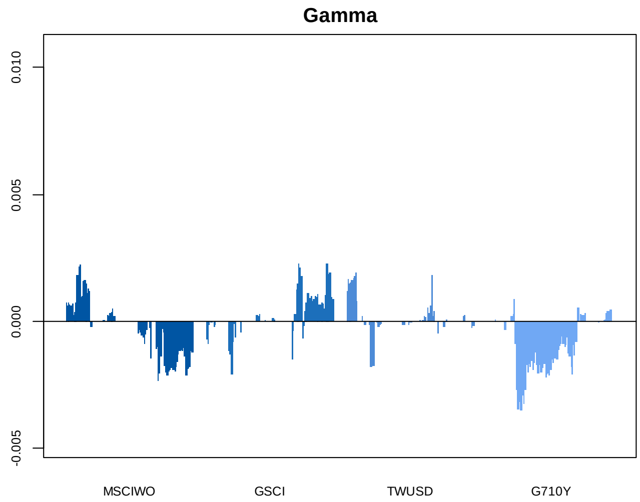
Rolling correlation to Eureka Hedge Event Driven Multi Strategy 36mth:

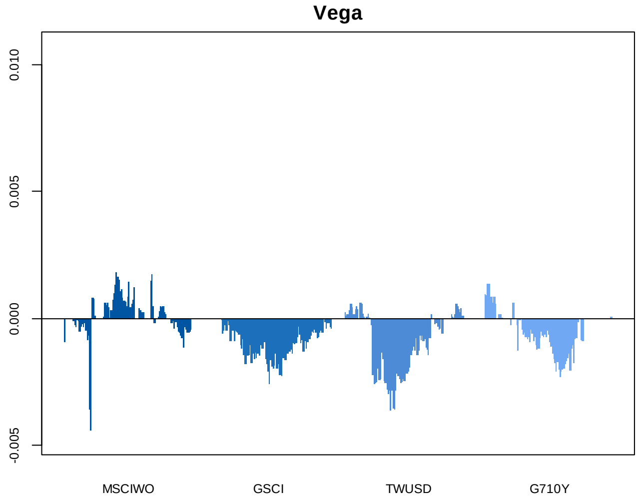


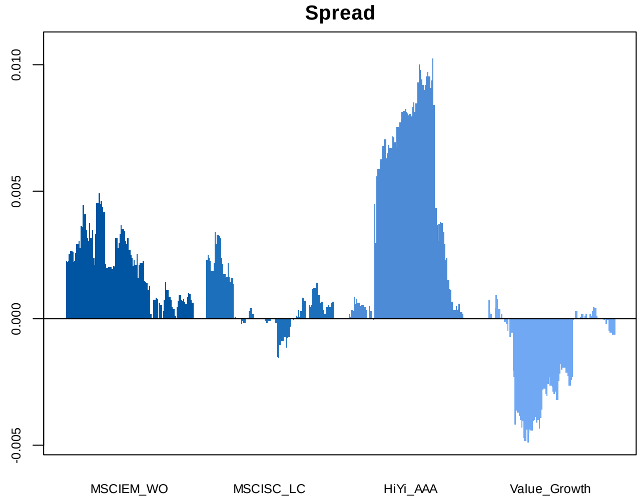
In search for a reasonable benchmark for the fund, the hedge fund class Event Driven Multi Strategy from Eureka Hedge could be a possible candidate. Not only is the fund highly correlated with this benchmark during crisis but also 75% of the peer group face an average correlation of more than 0.7. Nevertheless, the fund as well as the median peer group fund faced a decrease in correlation over the past 12 months. Further analysis, which are not displayed here, revealed that the fund would have outperformed the Eureka index on a cumulative performance basis since inception.

Market-Factoranalysis









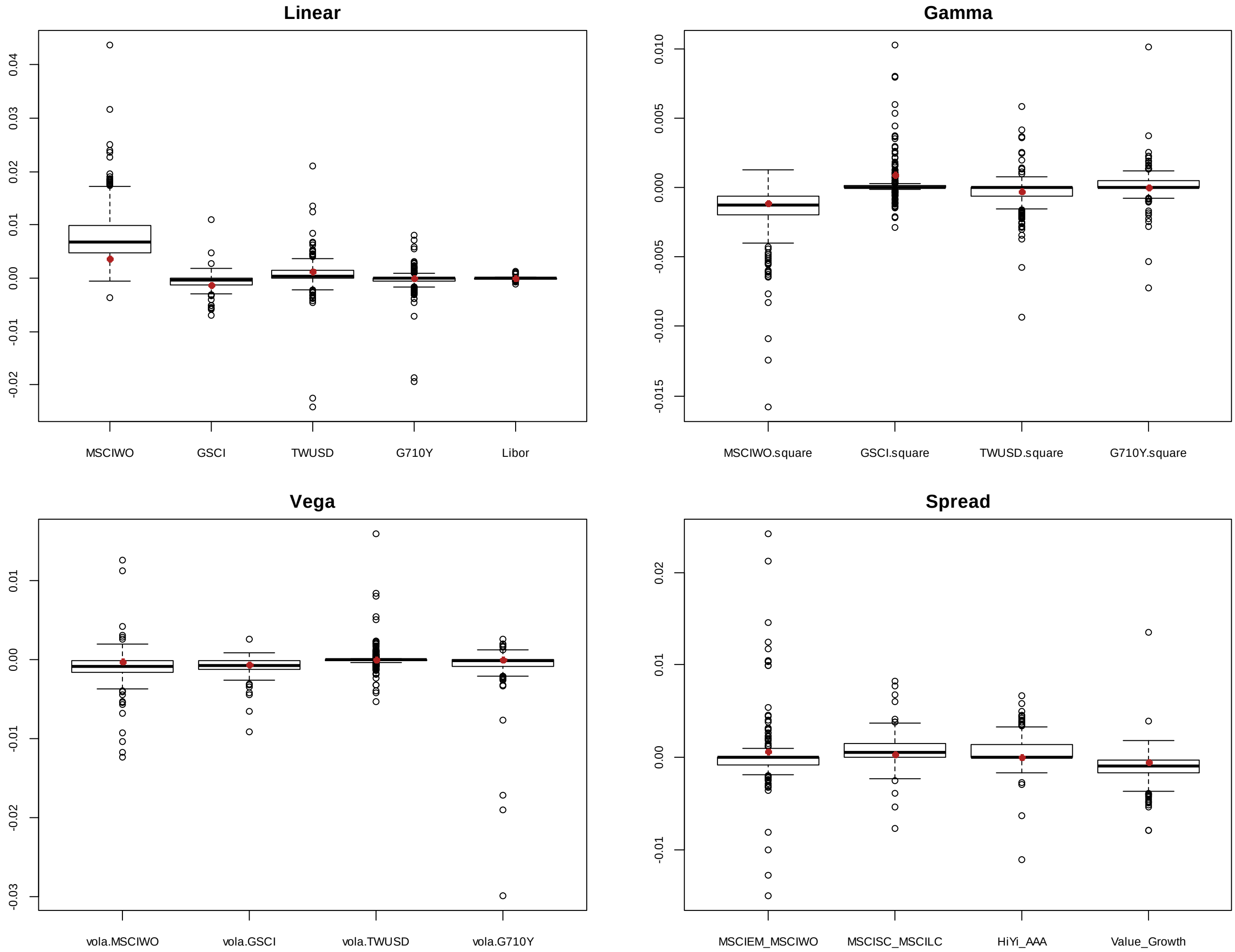
Linear (traditional) exposure	Non-Linear (Gamma) exposure
Risk exposures to the global equity market (MSCIWO) as well as commodities (GSCI) were most prominent for the entire period. The fund increased his equity market risk exposure during 2007 and the first half year of 2008. With the beginning of the financial crisis the fund already reduced his exposure to equity markets and did this for the following three years. After having an almost net exposure to equity markets from October 2011 to February 2013, it slightly increased his risk exposure again. The fund faced a short commodity exposure until July 2008. Since the end of 2008 through mid-2012 the fund was heavily exposed to commodity risk.	With the positive gamma exposure to commodity markets the fund is earning positive returns since the end of 2012. With the negative exposure to the government bond market (G710Y) the fund had a negative return contribution within the period October 2008 to November 2012. The same holds true for the MSCI World exposure for the period October 2011 to June 2015.
Volatility (Vega) exposure	**Spread exposure**
Generally we would like to see positive volatility exposure in those factors as it is understood as a protection in highly volatile and negative market environment. The fund had a negative world equity exposure until the financial crisis. In November and December 2008 the fund must have closed some of his positions as a drastic turn is observed. After the financial crisis of 2008 the fund had a positive volatility exposure until the end of 2013 and turned again slightly negative for the last couple of months.	The emerging market versus world equity spread shows a bias towards emerging market investments. Furthermore, the credit spread factor (HiYi – AAA bonds) measured a heavy exposure towards high yield bonds which implies exposure to credit risk. This exposure has been drastically reduced in the last couple of months. With the value-growth spread the model measured a growth bias for the period of September 2008 to September 2012, which implies that the fund was more sensitive to growth equity risk.

The main risk drivers and their implication for the last three months have been.

- Positive linear world equity exposure
  - The fund returns are sensitive to the evolution of world equity markets
- Negative linear commodity exposure
  - The fund seems to be short on commodities for the last couple of months
- Negative gamma exposure for world equity
  - The fund constantly loses money from this exposure
- Negative volatility exposure for world equity
  - Extreme negative events on equity markets would negatively affect the fund performance

Market-Factor-Analysis to Peer

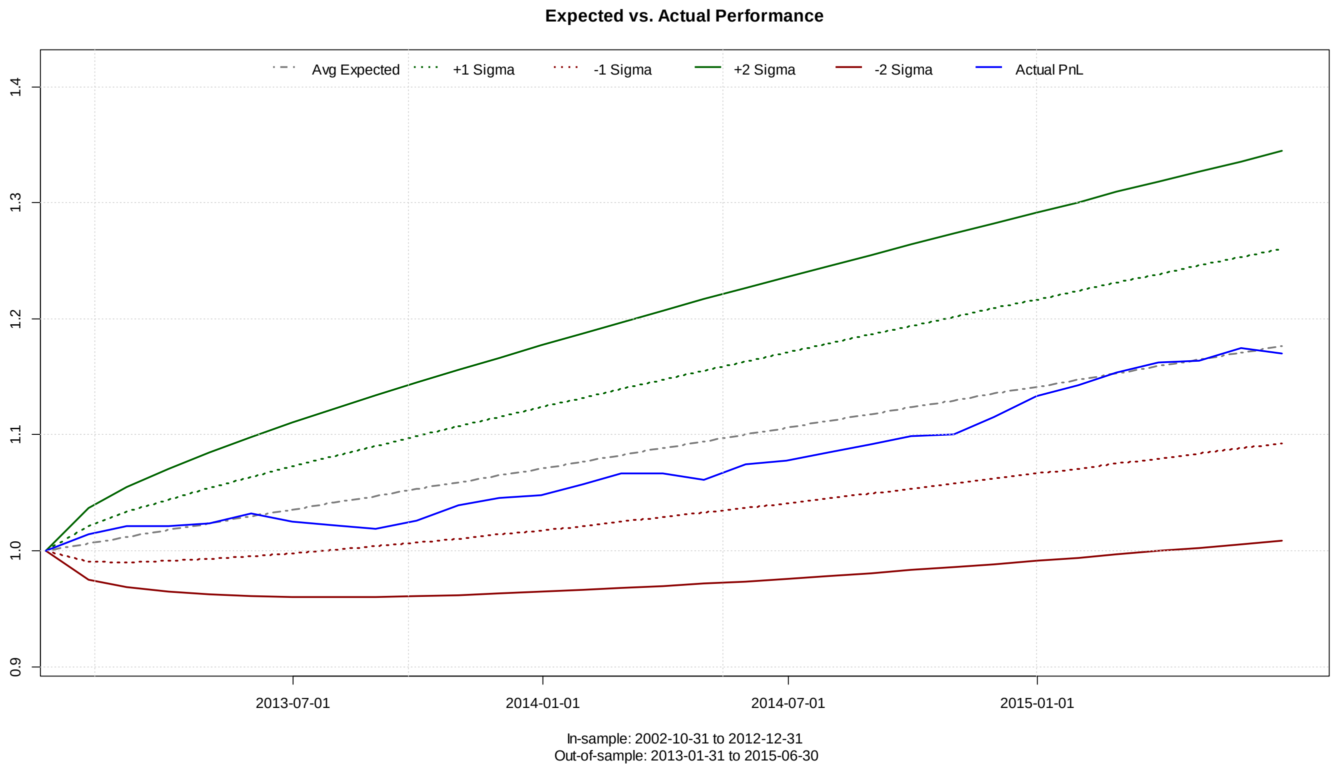
The quantitative assessment of factor analysis for June 2015 shows that its risk profile corresponds mostly to the peer group median. In fact, we can only observe a small difference to linear MSCI World exposure as well as a slightly more exposed emerging market bias (long spread MSCIEM-MSCIWO).



Simulations

The expected versus actual performance figure shows an out-of-sample performance analysis and can be seen as a risk management tool. On the time window of almost 10 years (Oct. 2002 to Dec. 12) an in-sample fit was performed. Then the out-of-sample expectation as well as the +/- one and two sigma standard deviations (68%, 95% confidence interval) are forecasted for January 2013 to June 2015. If the actual P&L of the fund would cross the standard deviation lines, it can be interpreted as a sign of change. In such a case the past return distribution does not fit the actual distribution anymore.

To sum it up, including the financial crisis the fund fits his past returns for the out-of-sample period.



Monte Carlo Simulation of CAGR and Maximum Drawdown:

The Monte Carlo Simulation forecasts the returns and the maximum drawdown for the next two years. In three out of four years (CAGR25) the simulation predicts an annualized return of 7% or higher. In one out of twenty years the maximum drawdown will exceed 9%.