QUEST PARTNERS LLC

AlphaQuest CTA Research Series #1

The goal of this research series is to demystify specific black box CTA trend following strategies and to analyze their characteristics both as a stand-alone product as well as within a portfolio of typical financial instruments.

Black Box Trend Following – Lifting the Veil

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Synopsis

The goal of this paper is to help CTA investors familiarize themselves with black box trend following strategies. The paper highlights the sensitivity of returns to some of the optimizations that are available.

Specifically, we will

1) Provide transparent CTA black box trend following trading strategies including specific parameters, markets to be traded and risk management strategies.
2) Analyze the source of returns of such trading strategies and compare their returns to the Barclays BTOP 50 Managed Futures Index (BTOP50) and the S&P 500 Index (SP500).
3) Break down performance per sector and per trade direction (long vs. short).
4) Investigate the stability of the parameters used.
5) Explore the capacity of such strategies to hedge stock market risk.

Some of our findings are:

1) Simple, liquid and fully transparent CTA strategies such as moving average crossovers and channel breakouts explain most of the returns of the BTOP50. These strategies are stable across parameters.
2) These simple strategies compare favorably to the BTOP50 and the SP500 both in terms of returns and risk adjusted returns.
3) These strategies have positive skew. They tend to benefit from increases in volatility and SP500 down moves.
4) In the past 20 years, most of the returns of these strategies has come from long trades, the fixed income sector and longer term trading frequencies. Optimizing around these data points should be done with care.
5) The SP500 lost about 130% in its worst 4 drawdowns of the past 20 years, in these same 4 periods, the 2 strategies we proposed generated over +140% each.

I. The Strategies

Strategy Mechanics

The two technical indicators that are most commonly used as trend following filters are Channel Breakout and Simple Moving Average Crossovers. These 2 indicators have been used since the early 70's or before. Both these indicators have high correlation to CTA indexes and traditional CTAs. As such, they are a great proxy for the strategies that CTAs use in their portfolios. We can use their performance to study the performance of CTAs in general. Both strategies, in the form that we are going to discuss, are pure reversal strategies; they are always in the market long or short. Both strategies use daily data for their computations. Both strategies are stable across parameters as will be shown. For our purposes, we will specifically use the 50 Day Channel Breakout (CB50) and the 10x100 Simple Moving Average Crossover (MA10x100) strategies. These are the trading rules for the models:

50 Day Channel Breakout (CB50):
C = close of today
HC(50) = highest close in the last 50 days (including today)
LC(50) = lowest close in the last 50 days (including today)

Long Signal: If C = HC50 then go Long tomorrow market on open
Short Signal: If C = LC50 then go Short tomorrow market on open

10x100 Simple Moving Average Crossover (MA10x100):
MA10 = average of the last 10 closes (including today)
MA100 = average of the last 100 closes (including today)

Long Signal: If MA10 > MA100 then go Long tomorrow market on open
Short Signal: If MA10 < MA100 then go Short tomorrow market on open

Markets Traded

We apply each of the two trend following models to a diversified portfolio of 24 foreign exchange and futures markets. These markets comprise 4 distinct sectors: foreign exchange, fixed income, equity indexes, and commodities. Risk is allocated equally to all sectors. There are 6 markets in each sector:

Foreign Exchange	*Fixed Income*	*Equity Index*	*Commodity*
EUR/USD	US Bond (30Y)	S&P 500	Light Crude Oil
GBP/USD	US Note (10Y)	Nasdaq 100	Heating Oil
EUR/GBP	German Bund (10Y)	Euro Stoxx 50	Natural Gas
EUR/JPY	Japanese Govt Bond	Dax	Gold
USD/JPY	Eurodollar (3M)	Nikkei 225	Silver
GBP/JPY	Euribor (3M)	Hang Seng	Corn

Data Notes

Daily sampled data was used. Continuous price series for futures contracts were created using a standard back-adjusting mechanism relying on contract open interest as roll trigger. Bloomberg was used as a source for historical cash foreign exchange data. For the sake of simplicity, interest rate differences between currencies were ignored as they have negligible impact on our results.

Trade Sizing

All markets are allocated equal risk at trade entry. Position sizing is proportional to account size and inversely proportional to market volatility. The measure of volatility that was used is the standard deviation of daily price changes (not the standard deviation of daily percentage price changes). Volatility was measured over a 100 day period preceding each trade. All 24 markets were treated identically. Position size was determined at trade inception and was kept constant until trade was closed.

TS = 0.001 * AS / (VOL * PV)

TS - Trade Size in # contracts at trade initiation
AS - Account Size in USD at beginning of the month
VOL - Volatility as measured by standard deviation of daily price changes over the preceding 100 days
PV - Point Value in USD for 1.0 point move in price for 1 contract

This methodology of trade sizing is simple and robust. Unlike some other trade sizing methods such as fixed number of contracts per trade or fixed USD face value allocation per trade, it is independent of nominal price level and it can be applied in identical fashion across several market sectors.

Sector Weights

The selected markets are highly liquid. They comprise the majority of the liquidity available within each respective sector and are representative of the exposure of a typical CTA today. It is important to note that from the late 80s to the early 90s, CTAs shifted a considerable amount of risk exposure from the commodity and FX sectors to the financial and stock indexes sectors. We assume a fixed sector allocation over time in our simulations.

Time Span

The time period of our study spans over 20 years starting January 1990 and ending June 2010. Some markets that we used in our tests did not exist in 1990. In these cases, we used data from market inception onwards. Of the markets we chose to use, 22 were active as of December 1990, and all were active by December 1998. Special consideration was given to the Euro currency which was introduced January 1st 1999. Prior to January 1st 1999, the German Mark was used instead of the Euro in the relevant foreign exchange crosses.

Commission and Slippage

Throughout the study, we used conservative commission and slippage assumptions. Commissions were assumed to be $24 per round turn for futures contracts. Slippage assumptions were contract specific and averaged $87 per round turn. For the CB50 and MA10x100 strategies, this translates into slippage and commission costs of 2% and 2.58% per annum respectively. We note that in the 80s and 90s, prior to introduction of electronic exchanges, markets weren't as liquid as they have been over the past decade. The execution cost assumptions used in this study are significantly higher than those experienced during the past 10 years of live trading at Quest Partners but are appropriate for the overall study period.

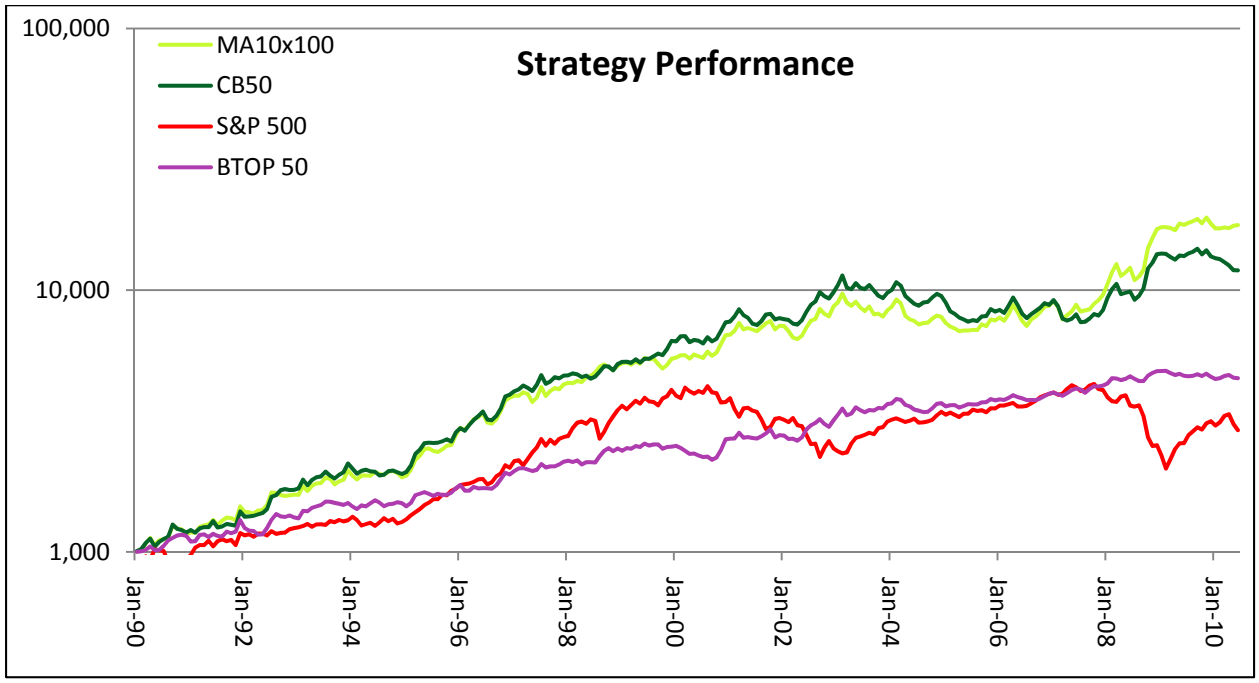
Interest

Assuming a fully funded trading account, full interest was included in the simulated performance results. The 1-month USD Libor was used to calculate the interest return on the cash held in the trading account.

Fees

Where indicated, fees of 1% management and 20% incentive were charged on the strategies' accounts.

II. Performance Results and Graphs



The above logarithmic scale chart shows cumulative NAV curves for the two trend following strategies, the SP500 and the BTOP50.

	MA10x100	MA10x100 (with fees)	CB50	CB50 (with fees)	SP500	BTOP50
Annual Compounded Return	15.1%	11.2%	12.8%	9.5%	5.4%	7.7%
Worst Peak-to-Trough Drawdown	-28.2%	-24.3%	-33.7%	-29.9%	-52.6%	-13.3%
Annual Standard Deviation	15.8%	12.6%	15.3%	12.2%	15.0%	9.5%
Annual Return/Max P/T Drawdown	0.53	0.46	0.38	0.32	0.10	0.58
Sharpe Ratio (Avg RFR=4.26%)	0.68	0.55	0.56	0.43	0.07	0.37
Skew	0.25	0.25	0.29	0.29	-0.65	0.43
Correlation to SP500	-14.3%	-14.3%	-12.4%	-12.4%	NA	-11.9%
Alpha to SP500	11.0%	7.1%	8.7%	5.3%	NA	3.6%
Correlation to BTOP50	70.2%	70.2%	68.2%	68.2%	-11.9%	NA
Alpha to BTOP50	6.7%	3.7%	4.8%	2.2%	1.8%	NA
Beta to BTOP50	1.16	0.93	1.09	0.88	-0.19	NA
Avg # of Trades Per Year Per Market	4.0	4.0	3.0	3.0	NA	NA
Avg # of Days Per Trade	60	60	81	81	NA	NA

The **returns** of the two simple trend following strategies are attractive. Gross as well as net of fees, these simple models outperform the SP500 and BTOP50 indexes. The MA10x100 and the CB50 respectively annualized 15.1% and 12.8% over the 20 year period of study.

On a **return to maximum peak to trough drawdown** basis, the strategies outperform the SP500 by a factor of 3 or more. The strategies' return to maximum peak to trough drawdown is slightly less than that of the BTOP50. The index's outperformance can be explained by the fact that a substantial portion of its returns is due to interest earned on the funding capital rather than actual trading. We estimate that the interest earned on cash is about 4.26% out of the 7.7% return of the index.

The strategies' **Sharpe ratios** over the period are superior to SP500 and BTOP50 indexes. This holds even after management and incentive fees are deducted from the returns.

The **skew** of the strategies' returns is between 0.25 and 0.29, slightly under the skew of the BTOP50 but substantially higher than the negative skew of the SP500 returns. This implies that the strategies are a good hedge for surprises or increases in volatility. This is a valuable characteristic from a portfolio construction perspective. We will address skew and its importance in risk measurement and portfolio construction in a separate research note. Note that the negative skew on the SP500 implies that surprises tend to be negative for the stock market.

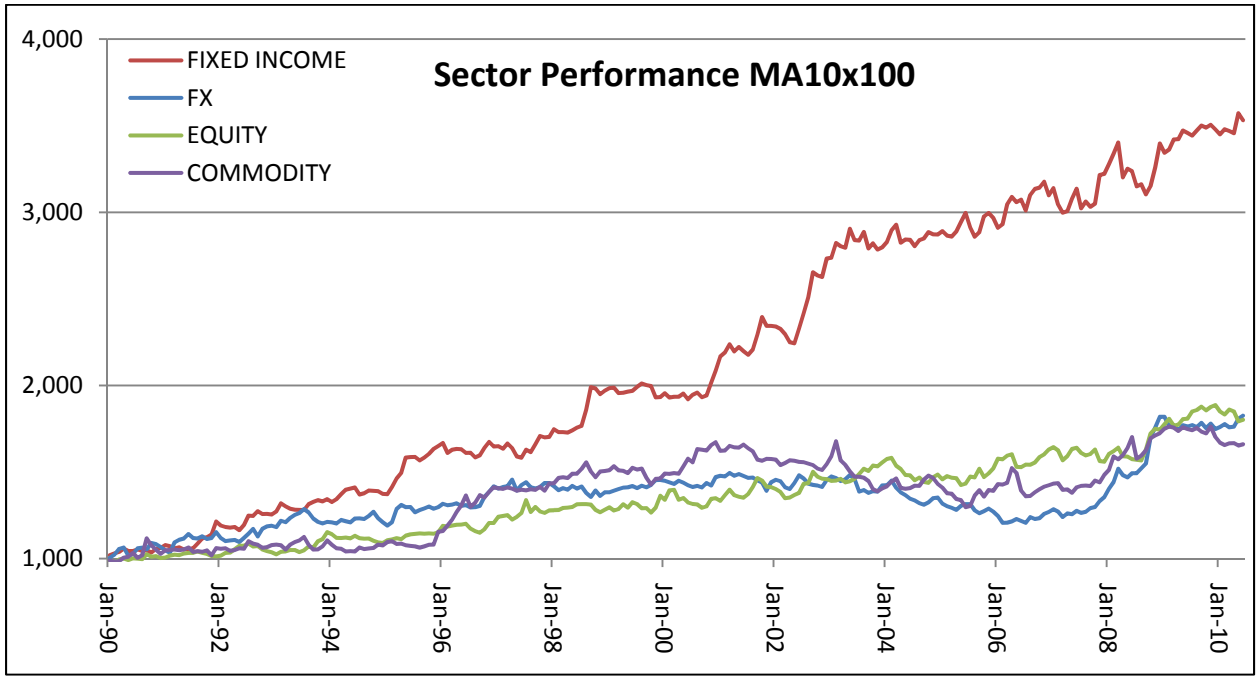
The **correlation of the strategies to the SP500** is slightly negative indicating that they are a good diversifier to the SP500. The **Alpha of the strategies to the SP500** is substantial at 5% to 11% per year. The ability of these strategies to hedge the SP500 is discussed in section VII of this paper and will be further analyzed in a separate research note.

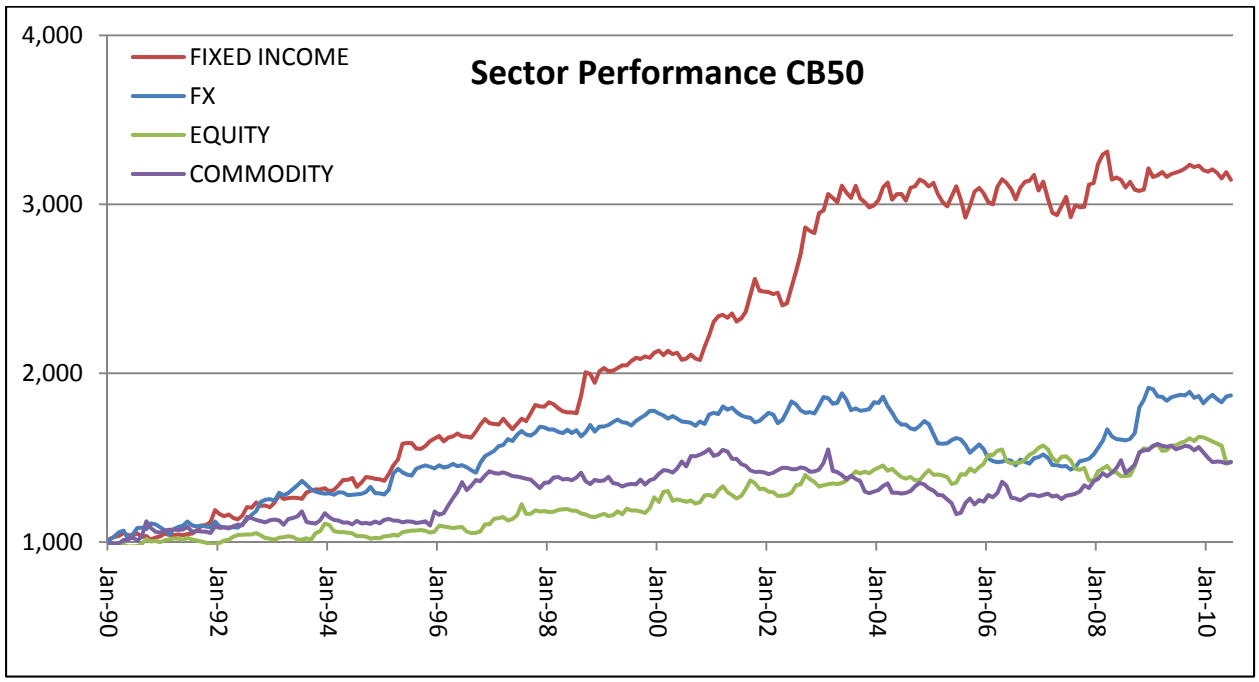
The **correlation of the strategies to the BTOP50** is high at around 70%. The **Beta of the strategies to the BTOP50** is around 1. These strategies are therefore very good proxies for CTAs and the CTA index in general. The models have 2.2% to 6.7% **Alpha to the CTA index**. A good portion of this Alpha is due to high fee structures and high commission rates that were prevalent in CTAs in the first 10 years of the study.

The returns of these strategies can be improved by diversifying the portfolio across more markets than the current 24. Another way to easily improve the results is by trading a diversified portfolio of these models using a range of parameters rather than the current fixed chosen values.

III. Sector Performance

We now point our attention to the performance of the strategies within specific sectors.





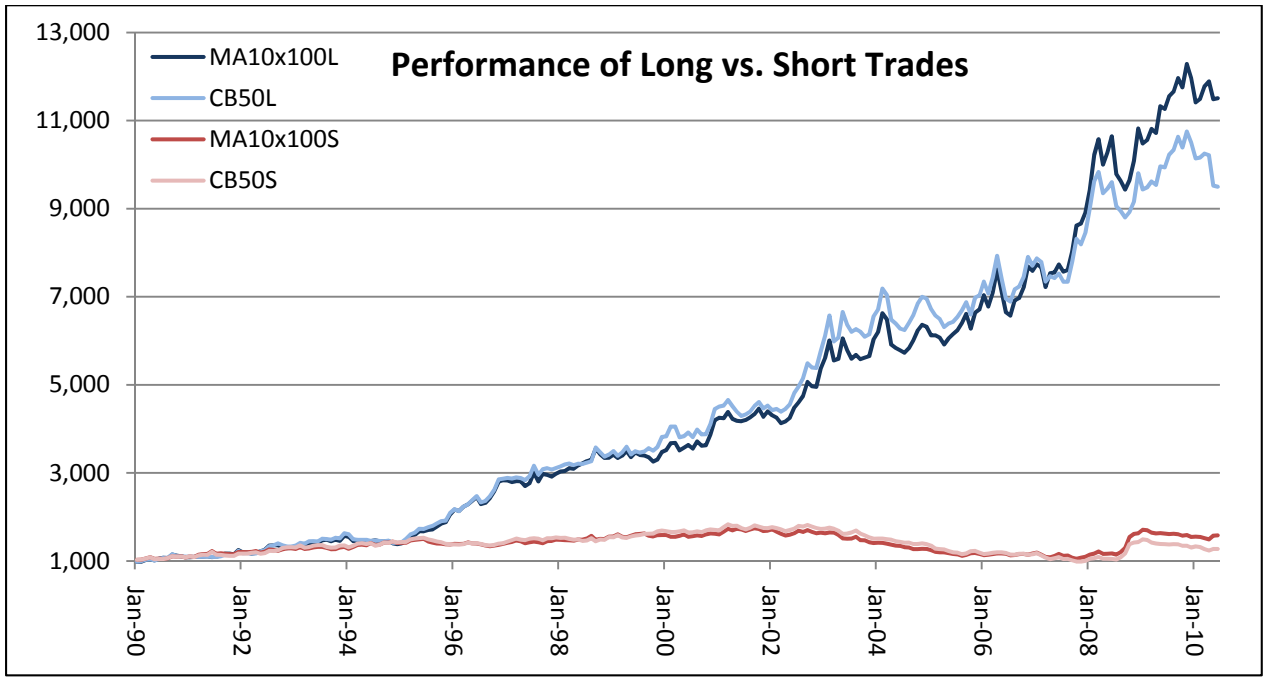
	MA10x100 FX	CB50 FX	MA10x100 FIXED INCOME	CB50 FIXED INCOME	MA10x100 EQUITY	CB50 EQUITY	MA10x100 COMMODITY	CB50 COMMODITY
Annual Compounded Return	3.0%	3.1%	6.3%	5.7%	2.9%	1.9%	2.5%	1.9%
Worst Peak-to-Trough Drawdown	-19.2%	-24.0%	-8.8%	-7.9%	-9.9%	-13.2%	-22.7%	-24.8%
Annual Standard Deviation	6.5%	6.2%	6.6%	6.6%	6.0%	6.1%	7.4%	7.0%
Annual Return/Max P/T Drawdown	0.15	0.13	0.72	0.73	0.29	0.15	0.11	0.08
Sharpe Ratio (Avg RFR=4.26%)	0.29	0.33	0.80	0.71	0.31	0.14	0.20	0.12
Skew	0.65	0.73	0.41	0.51	0.18	0.14	0.15	0.18
Correlation to SP500	-11.2%	-8.1%	-11.2%	-6.5%	-2.0%	-1.9%	-9.1%	-12.0%
Alpha to SP500	2.0%	2.1%	5.3%	4.7%	1.9%	0.9%	1.5%	0.9%
Correlation to BTOP50	53.3%	50.1%	53.2%	51.4%	33.9%	32.2%	27.9%	27.3%
Alpha to BTOP50	0.6%	0.9%	4.0%	3.4%	1.1%	0.1%	0.7%	0.1%
Beta to BTOP50	0.36	0.33	0.37	0.36	0.21	0.21	0.22	0.20
Avg # of Trades Per Year Per Market	4.7	3.2	3.7	3.0	4.0	3.0	4.2	3.2
Avg # of Days Per Trade	55	79	65	81	61	78	59	77

Individual Sector portfolios are assumed to be funded at 25%. If they were each fully funded, their annual compounded returns would each be higher by 3.19%.

It is clear that the best performing sector over the last 20 years is fixed income followed by FX, equities and commodities. For both models, over 45% of the overall return is derived from trading in this single market sector. This is an important factor to consider when comparing CTAs with a large portfolio weighting in fixed income as their outperformance might be confused with superior trading methodologies. Large CTAs tend to have outsized allocations to the fixed income sector due to its liquidity. The last 20 years have been a stellar environment for fixed income trading. The yields on the 30 Year US Treasury bonds have gone down from 8% in January 1990 to 4% in July 2010. It is highly unlikely that yields continue to drop as they have in the last 20 years. An up-trending fixed income market (yields going down) is highly favorable to a down-trending fixed income market due to the positive carry that is earned while being long (in a typically positively sloped yield curve).

IV. Performance of Long vs. Short Trades

Since the two strategies are entirely symmetric between the long and short side from a trading perspective, it is surprising to see how profitable the long trades are compared to the shorts.



	MA10x100	MA10x100 Long	MA10x100 Short	CB50	CB50 Long	CB50 Short
Annual Compounded Return	15.1%	12.7%	2.3%	12.8%	11.6%	1.2%
Worst Peak-to-Trough Drawdown	-28.2%	-13.7%	-39.9%	-33.7%	-13.6%	-46.1%
Annual Standard Deviation	15.8%	12.2%	8.9%	15.3%	12.0%	8.7%
Annual Return/Max P/T Drawdown	0.53	0.92	0.06	0.38	0.85	0.03
Sharpe Ratio (Avg RFR=4.26%)	0.68	0.87	0.02	0.56	0.79	-0.11
Skew	0.25	0.00	1.66	0.29	0.09	1.56
Correlation to SP500	-14.3%	12.7%	-42.9%	-12.4%	14.1%	-41.3%
Alpha to SP500	11.0%	10.4%	0.4%	8.7%	9.4%	-0.7%
Correlation to BTOP50	70.2%	65.7%	34.7%	68.2%	64.0%	31.5%
Alpha to BTOP50	6.7%	7.6%	-1.0%	4.8%	6.7%	-1.9%
Beta to BTOP50	1.16	0.84	0.32	1.09	0.81	0.29
Avg # of Trades Per Year Per Market	4.0	2.0	2.0	3.0	1.5	1.5
Avg # of Days Per Trade	60	67	54	81	74	88

Individual Long and Short portfolios are assumed to be funded at 50%, if they were fully funded their annual compounded returns would each be higher by 2.13%.

The **returns** and **risk adjusted returns** of the long side of the 2 strategies are superior to the short side of the strategies. Both strategies produce over 85% of profits from trading on the long side of the market. The strategies spend about 45% of time on the short side of the market.

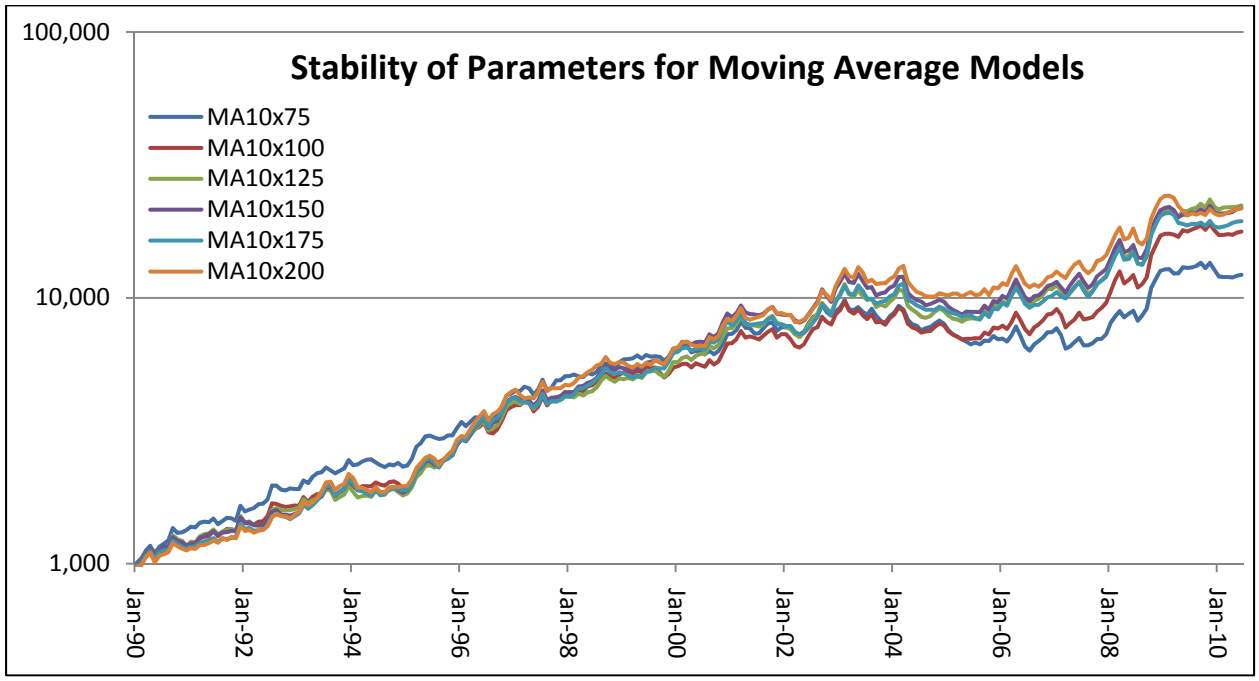
The long side of the trading strategies has a much higher **correlation to the SP500** than the short side and is therefore not as valuable as an addition to a portfolio of financial assets.

The long side of the trading strategies also has a much lower **skew** than the short (0 vs. 1.66 for the MA10x100 and 0.09 vs. 1.56 for the CB50). It is therefore not as stable in a volatile environment. The long side of the strategies has a neutral convexity while the short side is positively convex. Positive convexity should be a very high priority for CTA strategies as they are typically used as a hedge or diversifier in volatile and falling stock market environments. Skew is a very important factor in predicting the hedging potential of an investment.

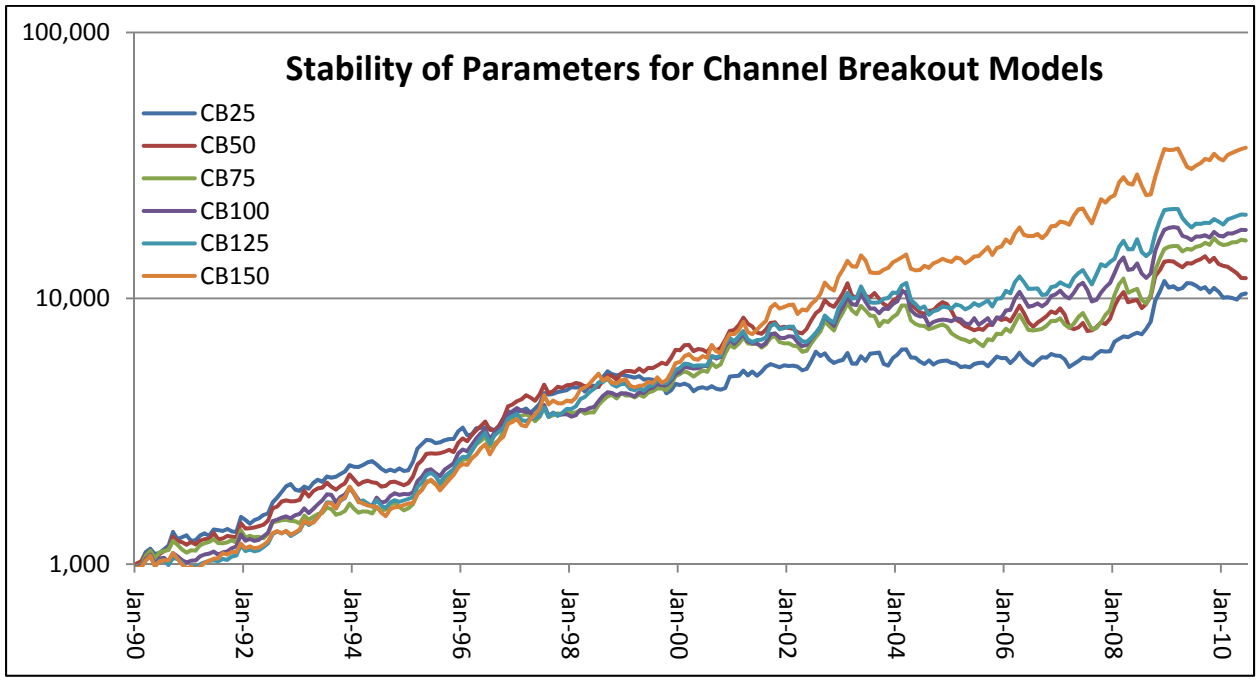
It is critical for investors into CTA strategies to be aware of the optimization risks that they are taking should they invest in a CTA who has improved his returns and risk adjusted returns through the trading of the long side of the markets only. We will discuss this anomaly in more detail in a future research note. We will also provide methods of return analysis that could shed light on whether a CTA is taking advantage of this characteristic to improve returns.

V. Stability of Parameters

We shifted the parameters of the MA10x100 and CB50 models to get a sense of how dependent our analysis is on the particular parameter choice we made.



	MA10x75	MA10x100	MA10x125	MA10x150	MA10x175	MA10x200
Annual Compounded Return	13.0%	15.1%	16.3%	16.2%	15.6%	16.2%
Worst Peak-to-Trough Drawdown	-35.4%	-28.2%	-27.8%	-30.1%	-26.8%	-23.4%
Annual Standard Deviation	15.1%	15.8%	16.1%	15.9%	15.7%	16.1%
Annual Return/Max P/T Drawdown	0.37	0.53	0.59	0.54	0.58	0.69
Sharpe Ratio (Avg RFR=4.26%)	0.58	0.68	0.75	0.75	0.72	0.74
Skew	0.27	0.25	0.25	0.10	0.19	0.07
Correlation to SP500	-14.8%	-14.3%	-14.6%	-13.3%	-13.4%	-12.9%
Alpha to SP500	8.9%	11.0%	12.2%	12.1%	11.5%	12.1%
Correlation to BTOP50	68.8%	70.2%	68.8%	68.3%	65.2%	63.2%
Alpha to BTOP50	4.9%	6.7%	8.0%	8.0%	7.6%	8.2%
Beta to BTOP50	1.09	1.16	1.17	1.14	1.08	1.07
Avg # of Trades Per Year Per Market	4.7	4.0	3.5	3.1	2.8	2.5
Avg # of Days Per Trade	51	60	68	78	86	95



	CB25	CB50	CB75	CB100	CB125	CB150
Annual Compounded Return	12.1%	12.8%	14.7%	15.2%	15.9%	19.2%
Worst Peak-to-Trough Drawdown	-17.4%	-33.7%	-31.3%	-25.1%	-24.1%	-22.6%
Annual Standard Deviation	13.8%	15.3%	15.9%	15.8%	16.1%	16.8%
Annual Return/Max P/T Drawdown	0.70	0.38	0.47	0.60	0.66	0.85
Sharpe Ratio (Avg RFR=4.26%)	0.57	0.56	0.65	0.69	0.72	0.89
Skew	0.71	0.29	0.46	0.11	0.02	0.05
Correlation to SP500	-14.7%	-12.4%	-15.7%	-13.5%	-9.6%	-4.0%
Alpha to SP500	8.0%	8.7%	10.6%	11.1%	11.8%	15.0%
Correlation to BTOP50	63.2%	68.2%	66.9%	62.2%	58.1%	53.0%
Alpha to BTOP50	4.7%	4.8%	6.5%	7.3%	8.2%	11.7%
Beta to BTOP50	0.91	1.09	1.12	1.04	0.99	0.94
Avg # of Trades Per Year Per Market	6.0	3.0	1.9	1.4	1.1	0.8
Avg # of Days Per Trade	40	81	126	171	222	292

Both the moving average crossover and the channel breakout models are stable across parameters. For both the MA and CB models, the longer term time frames had higher returns and risk adjusted returns. As an example, the 150 day Channel Breakout model compounded at over 19% per year vs. just under 13% for the 50 day Channel Breakout. The Sharpe ratio of the CB150 was 0.89 vs. 0.56 for the CB50.

It would be obvious that one should be trading the longer term strategies if it was not for the less positive skew that these strategies exhibit. Indeed these very long term strategies are much more vulnerable to dramatic reversals than their shorter term counterparts. As an example, in the large trend reversals of August 2007, the CB50 was up +0.5% while CB150 was down -5.79%. Similarly, the MA10x100 was up +0.95% while the MA10x200 was down -3.45%.

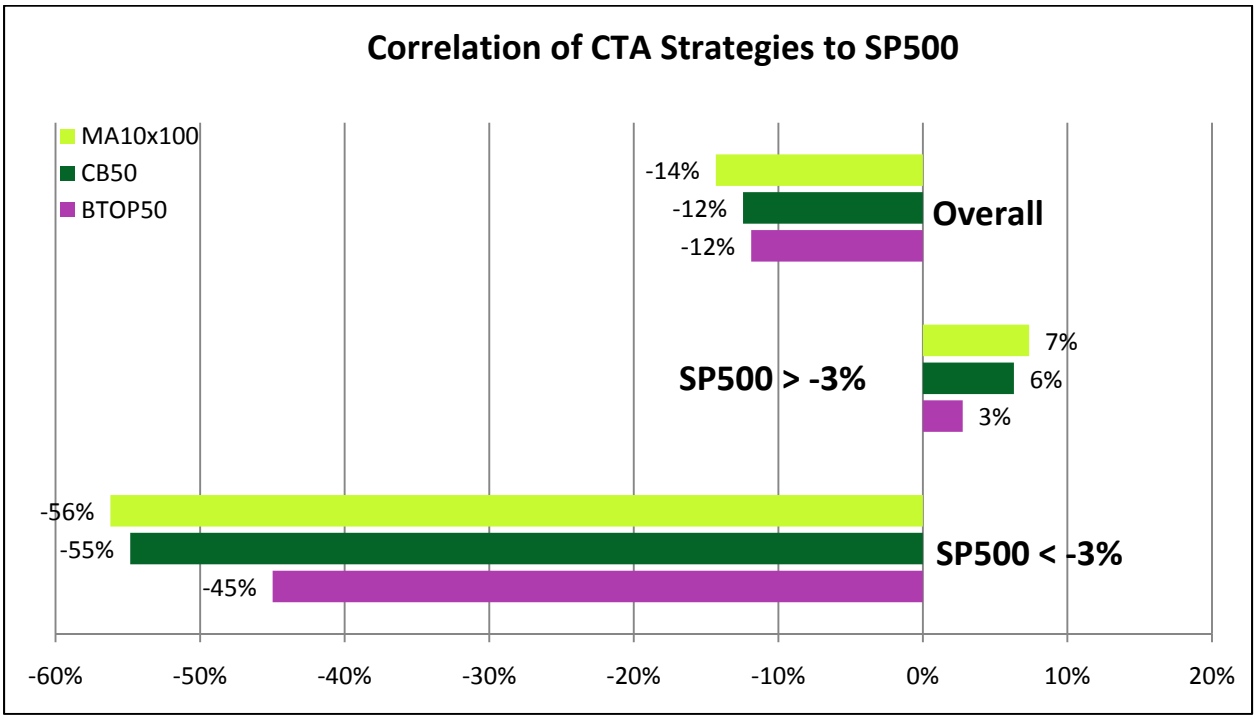
A point to consider is that large CTAs, due to their more significant slippage costs, tend to focus on the longer term frequencies of trading. This does not give them access to the positive skew which translates into strong hedging characteristics that are valuable in portfolios.

CTAs are typically expected to shine during such dramatic market reversals as those that occurred in August 2007. The longer term models do not have the reactivity that is necessary to meet such an expectation.

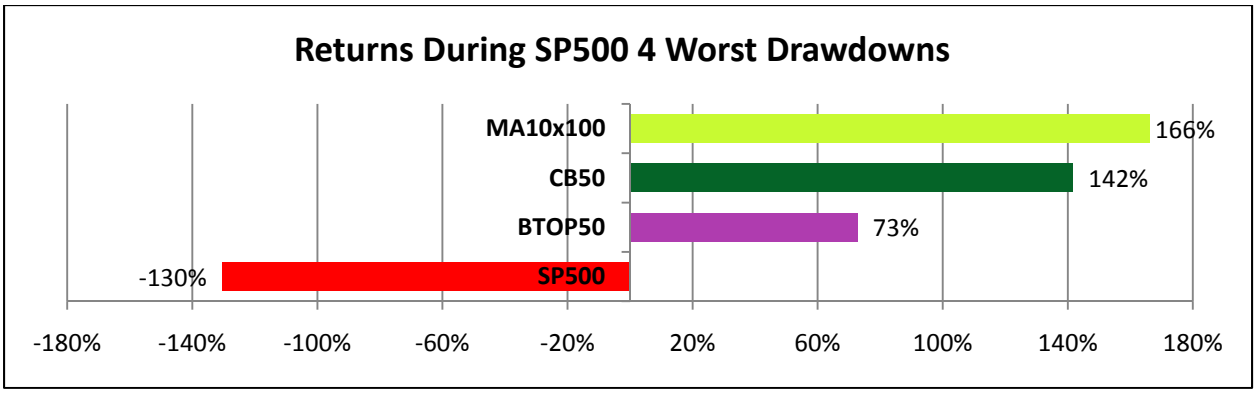
VI. Are CTAs a Diversifier or a Hedge to the SP500?

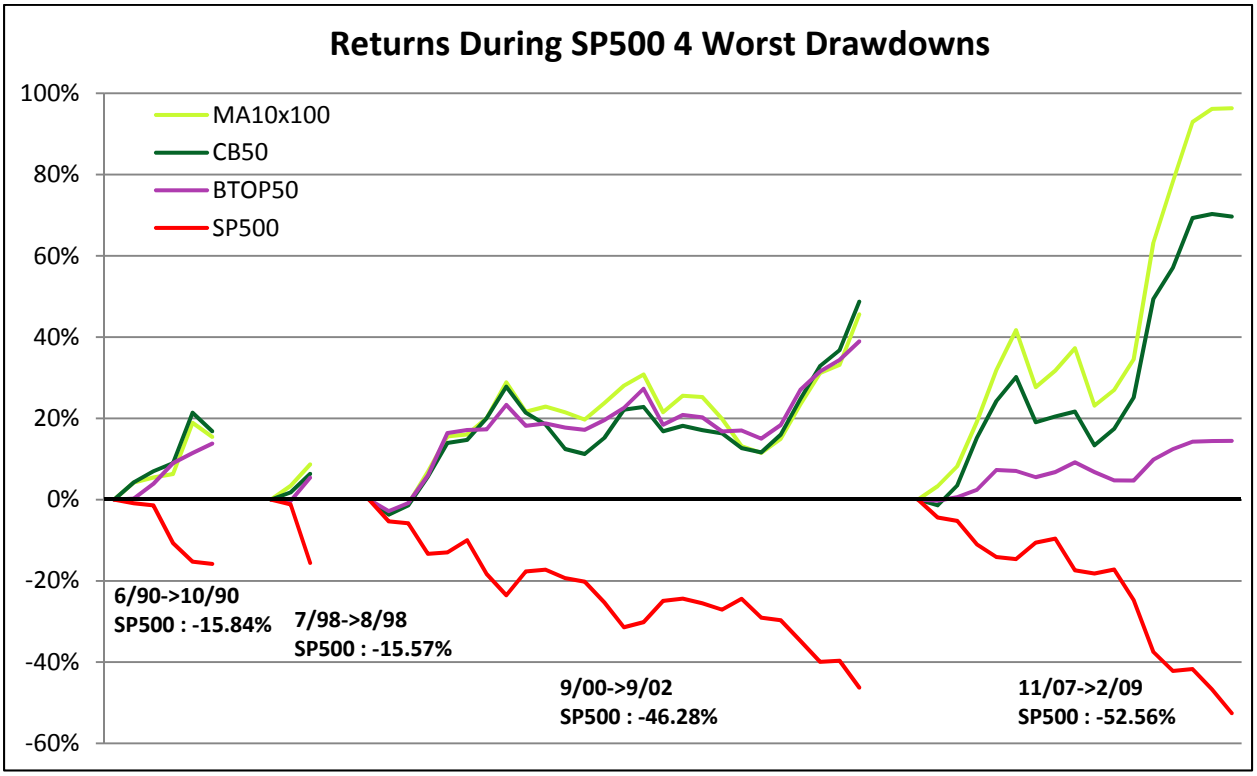
It is common knowledge that CTAs have only a slight negative correlation to the SP500 and are therefore not a hedge for the stock market and stock market related investments. CTAs are typically considered a diversifier for stock market risk and are therefore allocated a minor portion of typical financial portfolios.

On further analysis of this correlation number, one notices that in months when the SP500 is down -3% or more, the correlation of the CB50, MA10x100 and BTOP50 to the SP500 is actually a significant -45% to -56%. In other words, CTAs have a tendency to hedge stock market corrections without necessarily giving back returns during the SP500 up months. This makes CTAs a good hedge to stock market related investments. This strength is further compounded by the fact that our models and BTOP50 generate +4% to +7% annual Alpha to the SP500 and have substantial returns on their own. In effect, CTA strategies have long term positive returns and strong insurance characteristics. This is an exceptionally powerful combination that should be utilized in most portfolios.

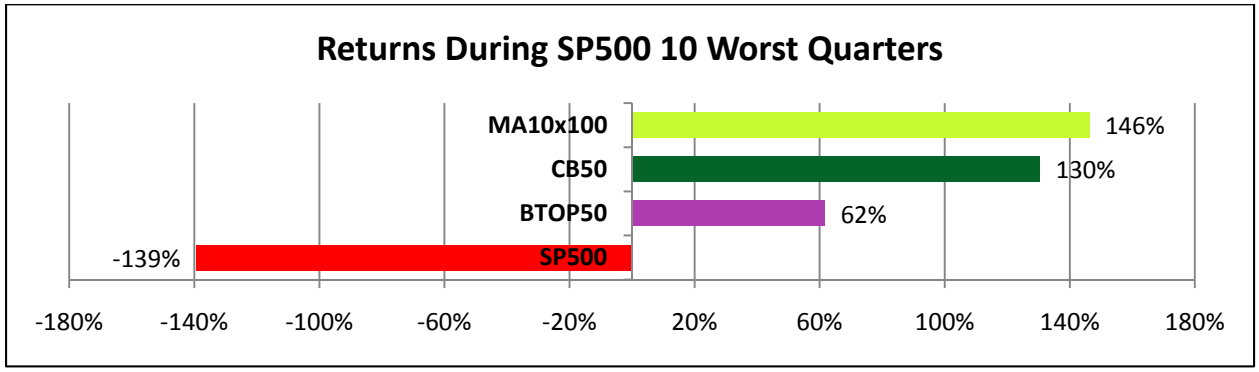


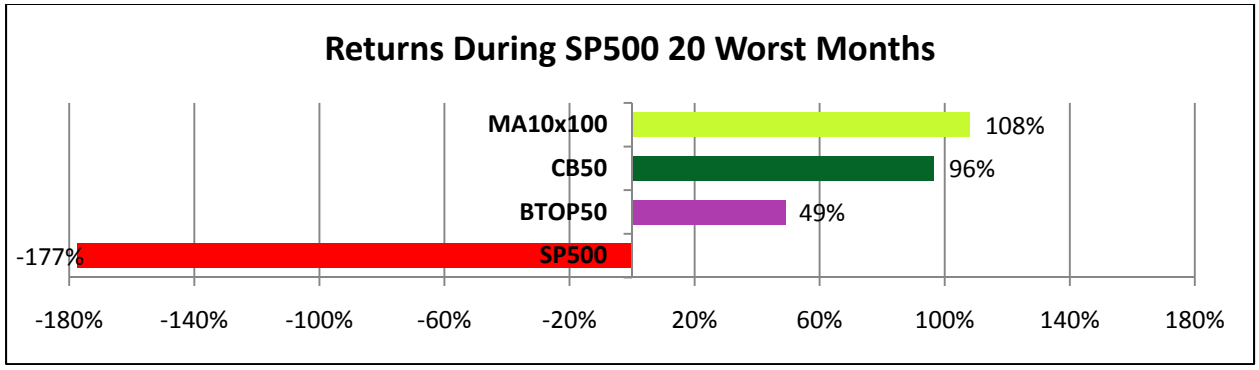
Next we consider the absolute returns of the CTA strategies during the worst 4 drawdowns of the SP500. In 4 periods when the SP500 lost a total of over -130%, the CTA strategies made +142% and +166% respectively. Few hedge funds strategies succeeded in generating positive returns during significant SP500 drawdowns in the past 20 years. As will be further analyzed in future research notes, these returns are a by-product of the positive skew that CTA strategies display. In effect, CTA strategies tend to benefit not only from trends, but also from the increases in volatility that inevitably occur during SP500 drawdowns. What is even more surprising is that this characteristic is not the by-product of option Gamma exposure but due to direct, liquid and transparent futures trading.





For illustration, we also include the returns of the 2 discussed CTA strategies and the BTOP50 during the 10 worst quarters and 20 worst months for the SP500. Both graphs confirm the hedge quality of CTAs during strong down quarters and down months for the SP500.





VII. Summary

1) The typical CTA and the CTA indexes can easily be duplicated using simple, well-known trend following filters such as moving averages and channel breakouts.
2) Models based on these trend filters have performed well as standalone investments.
3) These models have approximately -50% correlation to the SP500 when it is down more than -3% in a month. The hedging characteristic of these models comes without a commensurate downside during strong stock market periods.
4) During the last 20 years, three shifts in these models would have considerably improved performance relative to benchmarks. These shifts are: 1) increasing the weight of the fixed income sector (accounts for over 50% of the performance of the typical CTA portfolio), 2) trading the long side only (accounts for over 85% of the performance of the typical CTA portfolio) and 3) trading longer term frequencies than the typical portfolio. All three of these shifts negatively affect the ability to hedge stock market downturns. However, they improve risk adjusted returns during typical low volatility periods such as the ones that were experienced in the last 20 years. As we will discuss in future papers, these style drifts are apparent in the CTA index. Investors should evaluate CTA outperformance with special attention to these three variables.