QUEST PARTNERS LLC

AlphaQuest CTA Research Series #4

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.

Mean Reversion - Illustration of Irregular Returns in US Equity and Fixed Income Markets

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I. Introduction

In our previous research pieces[1], we argued that much of the Alpha evidenced in the hedge fund and CTA industries is not the result of skill but the result of exposure to tail risk in central bank influenced markets such as the US 30 year bond (US30Y) and its closely linked market, the SP500. Investors are relying on linear risk models which are inappropriate to measure the typical tail risk exposure of the hedge fund industry. The low correlation and low volatility of typical hedge fund allocations are both susceptible to predictable increases during equity market corrections. Overall risk is mispriced and Alpha is confused with skill. Furthermore, all hedge fund style sub-indexes, except CTAs, display increases in equity and tail risk exposure during equity market corrections. Market participants have learned to increase their exposure to equities during corrections as a way to boost returns in the ensuing rally. The lack of transparency of the hedge fund industry combined with the misalignment of interest of the incentive fee structure both contribute to this behavior as well. Investors do not differentiate non-skill based Alpha from the skill of superior security selection, for example, again due to the use of linear risk models in a non-linear risk world. With a non-linear risk model, the tail risk and increased equity exposure would easily be spotted. With a linear Beta model, the tail risk related returns appear as Alpha and therefore skill. The core factor at the source of this misguided allocation methodology is the unnatural and, what we believe, unstable mean reverting behavior of US equity and fixed income markets in the recent years. This behavior does not exist to the same degree in other sectors or international markets.

In order to illustrate the magnitude of this unnatural mean reverting behavior in the US30Y and SP500 markets, we provide a simple mean reversion model which we then apply to those two markets. The model applied to those two markets displays a highly profitable past as one would expect. The Sharpe ratio of the model applied to the two markets over the last 10 years is 1.57. We provide this model despite its stellar past not to convince readers of its validity but instead to illustrate the intensity of the mean reverting character of the SP500 and the US30Y markets in the last 10 years. We provide the back-tests on those two markets to trigger some self-doubt in the investment industry. This is something which we feel is lacking in the context of an exceptionally strong bull market of the last five years. By illustrating the availability of skill-less and unstable mean reversion based sources of Alpha, we hope investors will exercise sincere self-analysis of their methods of investment selection and also of the fees that they are willing to pay their managers. We believe that such markets, in particular, are highly vulnerable to substantial but unavoidable regime shifts such as the one experienced during the 2007-2009 crisis.

We will not explore these strategies as applied to other markets, during other periods or using other parameters. The parameters, markets and time period we have selected are optimized intentionally. The substantial Alpha we will display comes mainly due to the selected markets' behavior rather than due to parameter optimization. We do not trade such models nor do we recommend for anyone to trade them as we believe it is only a question of time before substantial losses are experienced in this or similar strategies.

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[1] - AlphaQuest CTA Research Series #1 Black Box Trend Following – Lifting the Veil by Nigol Koulajian and Paul Czkwianianc, Quest Partners LLC *September 2010*

- AlphaQuest CTA Research Series #2 Know Your Skew - Using Hedge Fund Return Volatility as a Predictor of Maximum Loss By Nigol Koulajian and Paul Czkwianianc, Quest Partners LLC *June 2011*

- AlphaQuest CTA Research Series #3 Quantitative Trend Following Strategies and Equity Risk: From Diversifier to Hedge By Nigol Koulajian and Paul Czkwianianc, Quest Partners LLC *April 2013*

II. The Model

We note that the number of parameters utilized to express mean reversion here is reasonable for a model applied to all markets similarly. In the context of the application of the model to two markets only, this might be considered an over-optimization.

BUY SIGNAL: The model goes long on the third down close if the market is down more than 5% of its Average True Range (ATR) on three consecutive days. ATR is defined as the average daily range (high to low) of the past 50 days[2].

SELL SIGNALS: Exit using whichever condition happens first.

1) TIME EXIT: Sell market-on-close on the 4th day since entry
2) STOP LOSS: Sell on a stop at yesterday's close minus 2 ATRs
3) PROFIT TAKE: Sell on a limit at yesterday's close plus 0.5 ATRs

Trade size is 50 contracts for both US30Y and the SP500.

Slippage and commissions are assumed to be $26 per contract per round turn for the SP500 (e-mini contract) and $30 per contract per round turn for the US30Y. The simulation starts on Jan 1, 2004. 24 hour data is utilized for both markets tested for ease of replication.

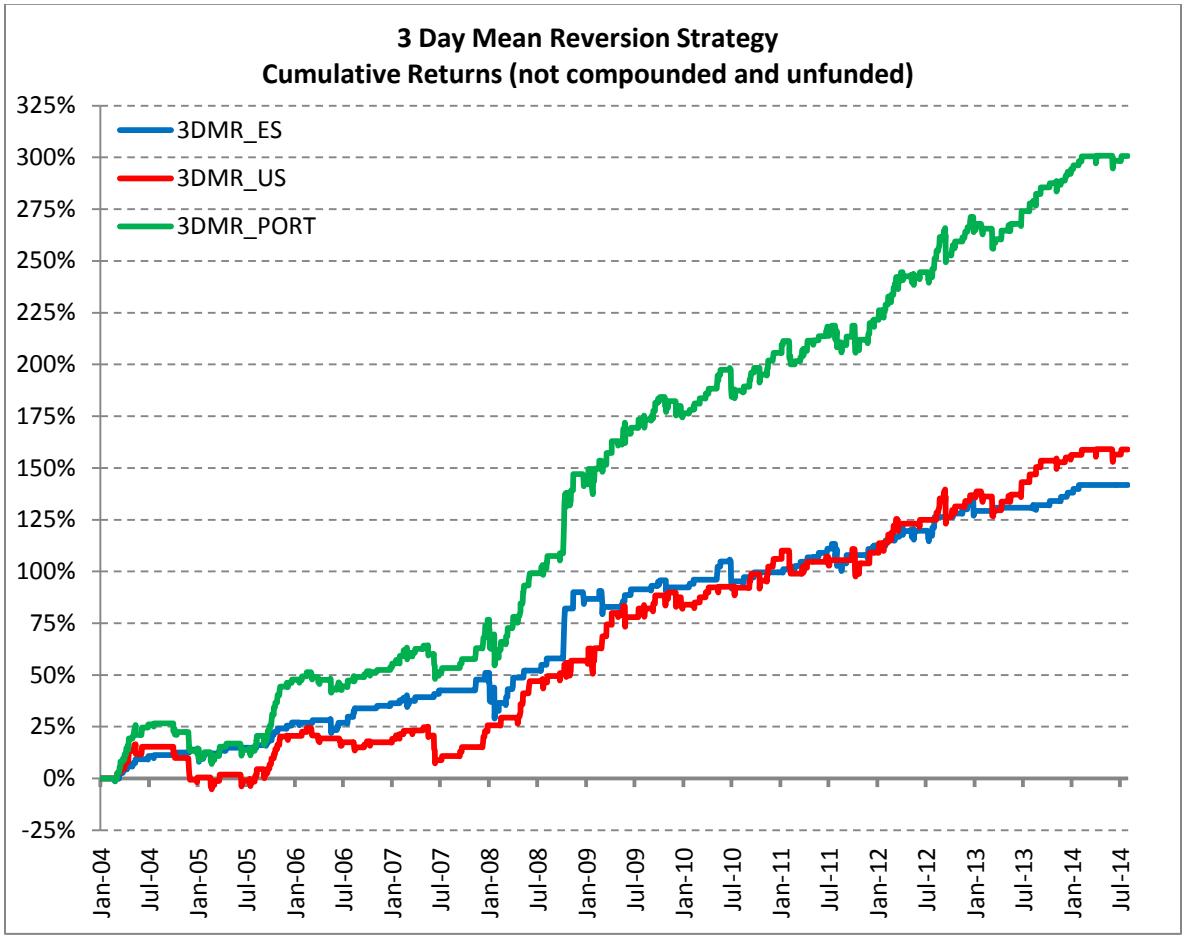
The TradeStation code for the model is:

```
Variable:
   down_days(3), max_holding_days(4), trade_size(50), average_daily_range(0), daily_price_change(0);

daily_price_change = Close - Close[1];
average_daily_range = AvgTrueRange(50);

// Buy MOC if market is down more than 5% of average daily range 3 days in a row:
If Marketposition = 0 and Highest(daily_price_change, down_days) < - average_daily_range * 5/100 then
        Buy("Entry") trade_size Contracts this bar at Close;

// Stop loss at 2 daily ranges from last close:
Sell("Exit_Stop") next bar at Close - 2*average_daily_range Stop;

// Profit take at half daily range from last close:
Sell("Exit_Prft") next bar at Close + 0.5*average_daily_range Limit;

// Exit after 4 days:
If BarsSinceEntry = max_holding_days then
        Sell("Exit_Fixed") this bar on Close;
```

[2] ATR is actually the maximum of 1) current high less the current low, 2) the absolute value of the current high less the previous close and 3) the absolute value of the current low less the previous close.

III. Simulation NAV Curves

3DMR_ES is the model applied to the SP500, 3DMR_US is the model applied to the US30Y and 3DMR_PORT is the model applied to the SP500 and US30Y simultaneously.

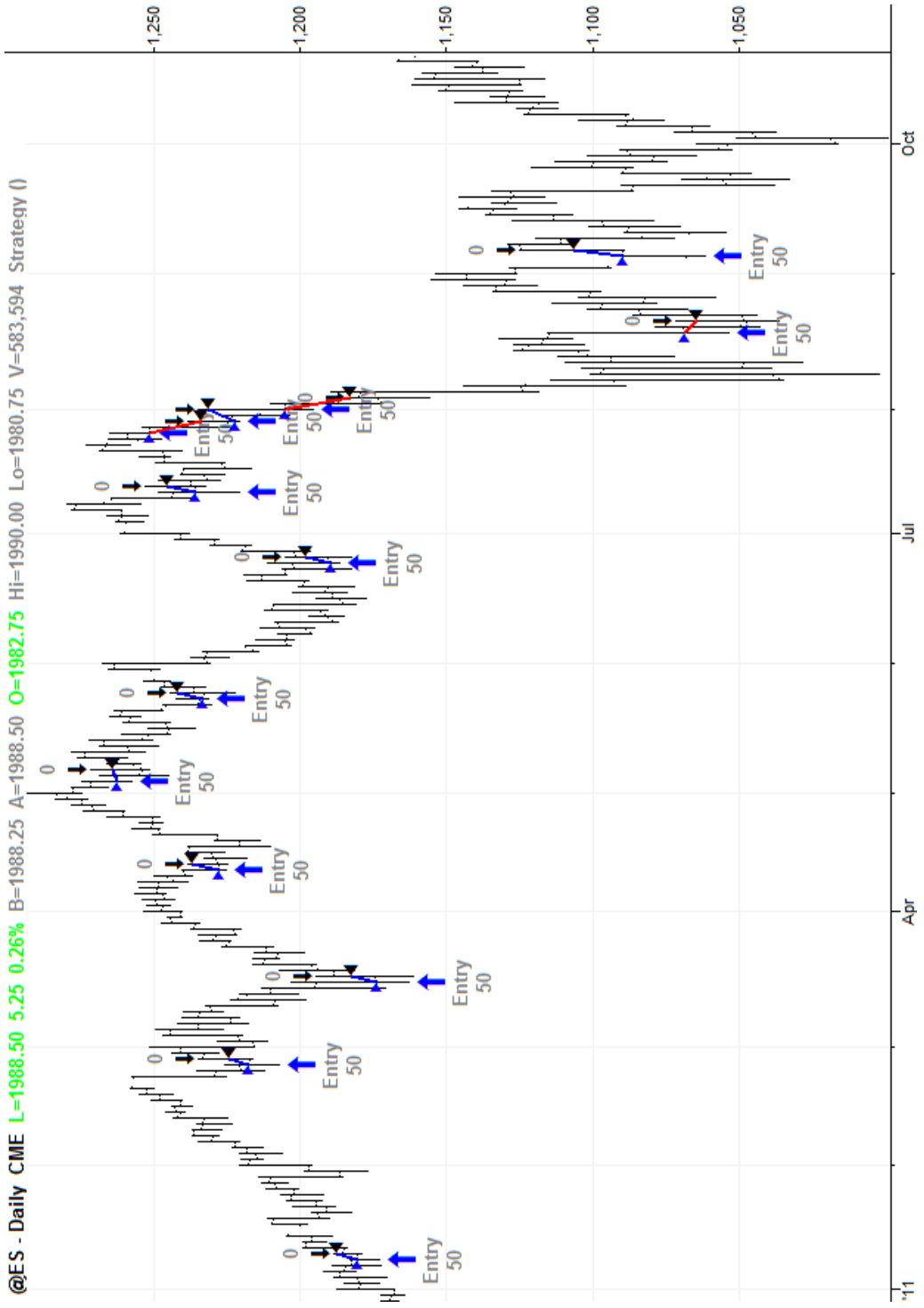


IV. Return and Trade Statistics

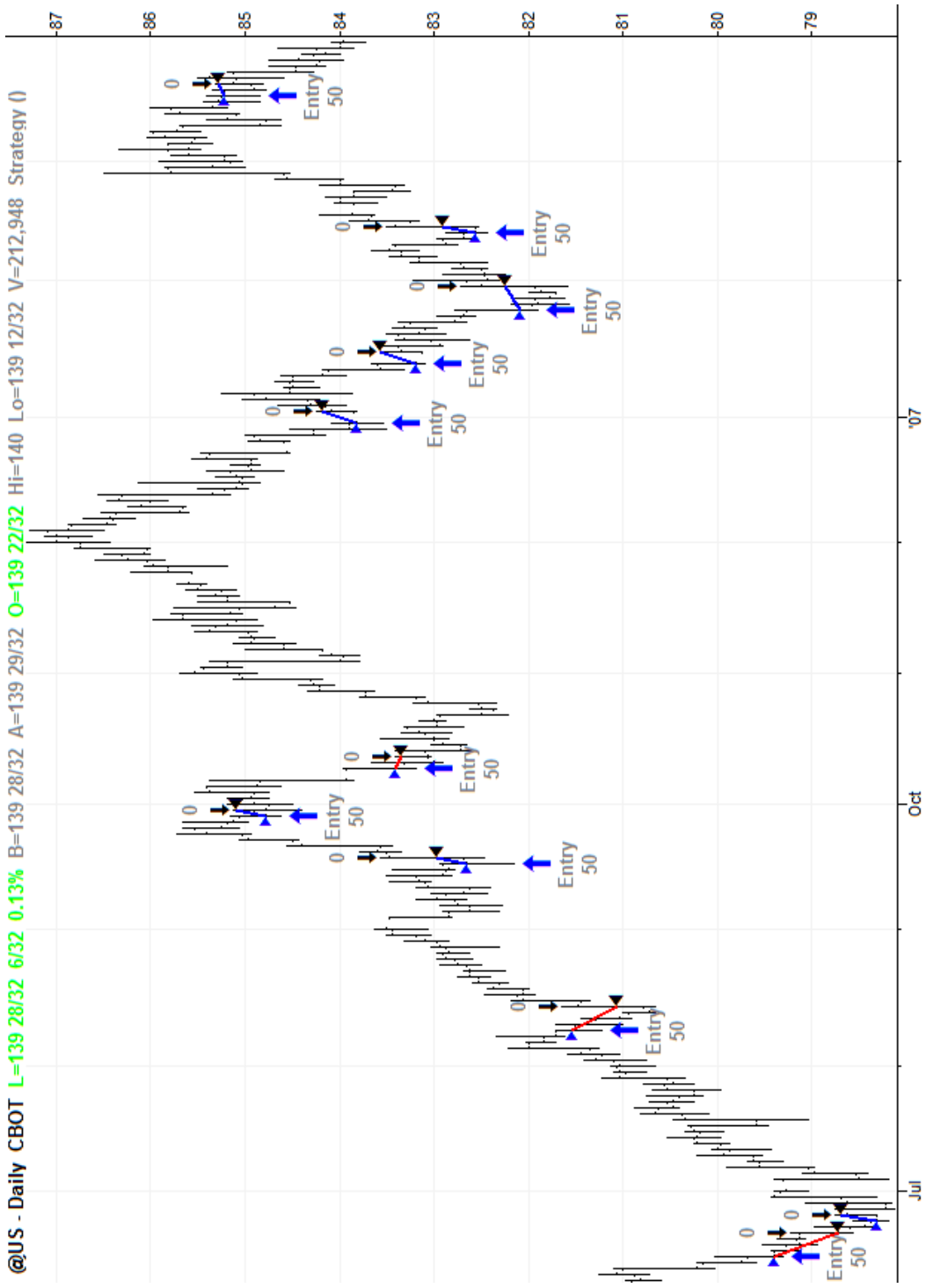
	3DMR_ES	3DMR_US	3DMR_PORT
Annualized Return (compounded)	13.3%	15.0%	30.1%
Annualized Return (only when position on)	120.0%	96.5%	118.7%
Annualized Volatility	12.8%	13.6%	19.2%
Worst Drawdown	-18.3%	-17.2%	-18.3%
Skew	0.57	-0.42	0.03
Sharpe Ratio	1.04	1.10	1.57
Ann Return / Worst Drawdown	0.73	0.88	1.64
Correlation to SP500	-22.1%	-1.3%	-15.6%
Annual Alpha to SP500	14.0%	15.1%	30.8%
Information Ratio to SP500	1.12	1.11	1.62
Correlation to HFI	-24.6%	-7.7%	-21.8%
Annual Alpha to HFI	15.7%	15.8%	33.3%
Information Ratio to HFI	1.13	1.11	1.64
Correlation to BTOP50	6.9%	-11.9%	-3.8%
Avg Trade	1.13%	1.10%	1.11%
Avg Winner	2.22%	2.66%	2.44%
Avg Loser	-5.05%	-4.00%	-4.38%
% Winning Trades	85%	77%	80%
Total Wins	237.8%	294.9%	532.8%
Total Losses	-96.0%	-136.0%	-232.1%
Largest Win	7.81%	6.73%	7.81%
Worst Loss	-14.9%	-13.3%	-14.9%
Number of Trades	126	145	271
Average Holding Period (days)	1.4	2.0	1.6

Funding is not included.

V. Sample Trades for SP500



VI. Sample Trades for US30Y



VII. Conclusion

The SP500 and US30Y markets have displayed superb characteristics for risk takers in the last 10 years. In particular, the return characteristics are highly suited for market participants betting on mean reversion and on the "market always coming back." The Sharpe and Information ratio of the model we provided are 1.57 and 1.62, both exceptionally high numbers. This characteristic has been facilitated by the perception that the FED will always provide liquidity when needed in case of a market correction. Tail risk is perceived to be minimal as a result of the "free FED put" and many funds, hedge funds in particular, are augmenting their returns by exposing themselves to this type of risk. Investors are incorrectly measuring the tail risk exposure of their fund and are allocating to funds with the highest Alpha. More often than not, the Alpha is not the result of superior security selection but the result of higher tail risk exposure.

With this simple model, we are illustrating a sample strategy and its stellar Sharpe and Information ratios. This is done in order for investors to appreciate how easy it has been to achieve skill-less Alpha which is highly unstable. Although the equity curves look deceivingly stable, the methodology is not. Many more mean reverting models such as this one do exist publicly and have performed extremely well in the past decade. An even simpler strategy with similar results involves shorting puts on the SP500 or for CTAs, just statically shorting the now liquid VIX futures.

Investors who use linear risk measures, such as the typical linear market Beta models, are most likely to confuse unstable tail-risk based Alpha with skill. Superior security selection is still rare and without a non-linear risk model, especially in the context of the current market, investors will have a very hard time discerning it from opportunistic, tail-exposed, replicable and highly unstable Alpha.