Hedging to reduce Drawdown

The unedited version of the following White Paper is available at this <u>post</u>.

Creating an Alternative Investment Strategy with Value and Momentum

July 7, 2016 Jack Vogel, Ph.D.

Anyone who follows our website should be familiar with the extensive evidence behind our favorite stock selection strategies:

1. Value Investing
2. Momentum Investing

The evidence suggests that high-conviction (<50 stock) value and momentum portfolios, deployed as a system, seems like a reasonable approach… if one has long-term horizon.

- We document why high conviction is important for both value and momentum strategies here and here.
- We document how value and momentum work as a system here.

But there is a potential problem: The analysis mentioned above is geared towards long-only investors looking for a better way to get their equity exposure. However, for some investors, a long-only value and momentum portfolio is not the ideal strategy. These investors need something different. For example, many investors ... want alternative exposures that exhibit less correlation and are not as susceptible to the gut-wrenching drawdowns associated with long-only investing.

The problem with many solutions in the alternative space (i.e., hedge funds) are the following:

1. High expenses
2. Little transparency
3. Low liquidity
4. Poor tax-efficiency

But is it possible to create a long/short equity hedge fund exposure with high conviction value and momentum portfolios? And is it possible to achieve this while maintaining 1) affordable fees, 2) full transparency, 3) high liquidity, and 4) improved tax-efficiency?

We believe the answer is **yes.**

In the section that follows we outline how investors can might access this exposure.

The mission is clear: *create an alternative investment exposure that exploits the most robust anomalies (value and momentum)*

There are three core steps to the process:

1. Identify a value and a momentum stock selection system
2. Combine the value and momentum stock selection system
3. Deploy a downside protection overlay

Step 1: Value and Momentum investing

Research is an essential part of what we do at Alpha Architect. The bulk of our research is on designing the most effective ways to capture value and momentum premiums. We don't claim to have all the answers or a corner on the market for great ideas, but we think we've identified evidence-based approaches to value and momentum via our quantitative value and quantitative momentum systems.

Quantitative Value

Our 5-step Quantitative Value strategy is outlined here:

1. **Identify Investable Universe:** Our universe generally consists of mid- to large-capitalization U.S. exchange-traded stocks.
2. **Forensic Accounting Screens:** We conduct financial statement analysis with statistical models to avoid firms at risk for financial distress or financial statement manipulation.
3. **Valuation Screens:** We screen for stocks with low enterprise values relative to operating earnings.
4. **Quality Screens:** We rank the cheapest stocks on their long-term business fundamentals and current financial strength.
5. **Investment with Conviction:** We seek to invest in a concentrated portfolio of the cheapest, highest quality value stocks. This form of investing is by definition contrarian, and requires disciplined commitment, as well as a thorough understanding of its theoretical and intellectual underpinnings.

Quantitative Momentum

Our 5-step Quantitative Momentum strategy is described here:

1. **Identify Investable Universe:** Our universe generally consists of mid- to large-capitalization U.S. exchange-traded stocks.
2. **Generic Momentum Screen:** We rank stocks within our universe based on their past twelve-month returns, ignoring the first month.
3. **Momentum Quality Screen:** We screen high momentum stocks on the "quality" of their momentum—we focus on stocks with a "smoother" return path towards their high momentum status.
4. **Momentum Seasonality Screen:** We take advantage of certain seasonal aspects applicable to momentum investing, which determines the timing of our rebalance.
5. **Invest with Conviction:** We seek to invest in a concentrated portfolio of stocks with the highest quality momentum. This form of investing requires disciplined commitment, as well as a willingness to deviate from standard benchmarks.

For those interested in more details, here are links to the books we have written on Value and Momentum.

Step 2: Combining Value and Momentum

Now that we have the core investment strategies (value and momentum), what is the best way to combine the two?

Here we outline that a 50/50 combination of the strategies is a decent first step. Another post was written about *why* one should combine value and momentum — the takeaway is that the two factors (in general) tend to work well at different times, so having an exposure to both is beneficial to the overall portfolio.

One can attempt to "time" the factors, but this seems like a fool's errand (see Asness' recent paper). But why? A relatively static value and momentum portfolio has known diversification benefits, as one factor tends to work well when the other factor is performing poorly. For this reason we recommend that investors don't get too cute:

1. Invest in concentrated value and momentum
2. Maintain a relatively static allocation across value and momentum
3. Have a long horizon

An equal-weight static allocation to value and momentum seems reasonable, but one might consider the fact that value and momentum strategies have dramatically different volatility profiles. A 50/50 allocation, from a volatility contribution perspective, will be heavily tilted towards momentum, since momentum portfolios generally have higher volatility relative to value portfolios. To address the unequal volatility profiles, one can balance risk exposures to value and momentum by volatility weighting each of the factors. Historically, a volatility-weighted value and momentum portfolio ends up with about 60% in value and 40% in momentum (using a past 36 month-look back period to estimate volatility).

Step 3: Downside protection

Timing the market is very difficult. Everyone wants to get high returns with little risk, but this desire is essentially impossible to achieve. Of all the options out there, trend-following seems to be the most promising. However, trend-based rules have not–**and cannot**–work all the time. So why bother with trend-based rules? Historically, long-term trend rules have helped equity investors manage the risk of large drawdowns. Here is a post where we examined domestic equity returns from 1/1/1801 until 9/30/15 using our trend system.

Our trend-following methodology is further described in our downside protection piece, but here are the high level details:

- **Absolute Performance Rule: Time Series Momentum Rule (TMOM)**
  - Excess return = total return over past 12 months less return of T-Bills
  - If Excess return >0, go long risky assets. Otherwise, go long alternative assets (T-Bills)
  - Concept made popular by Gary Antonacci
- **Trending Performance Rule: Simple Moving Average Rule (MA)**
  - Moving Average (12) = average of 12 month prices
  - If Current Price – Moving Average (12) > 0, go long risky assets. Otherwise, go long alternative assets (T-Bills).
  - Concept made popular by Meb Faber
- **Robust Asset Allocation Rule: Combination of TMOM and MA (ROBUST Downside Protection)**
  - 50% TMOM, 50% MA

Here is a chart of the 10 largest US drawdowns over a 200+ year period in domestic equity. We examine the 10 worst buy and hold drawdowns periods and show the corresponding performance of the equity drawdown when the downside protection system is in place.

Top 10 US Equity Drawdowns (1801-2015)

■ B&H   ■ Downside Protection
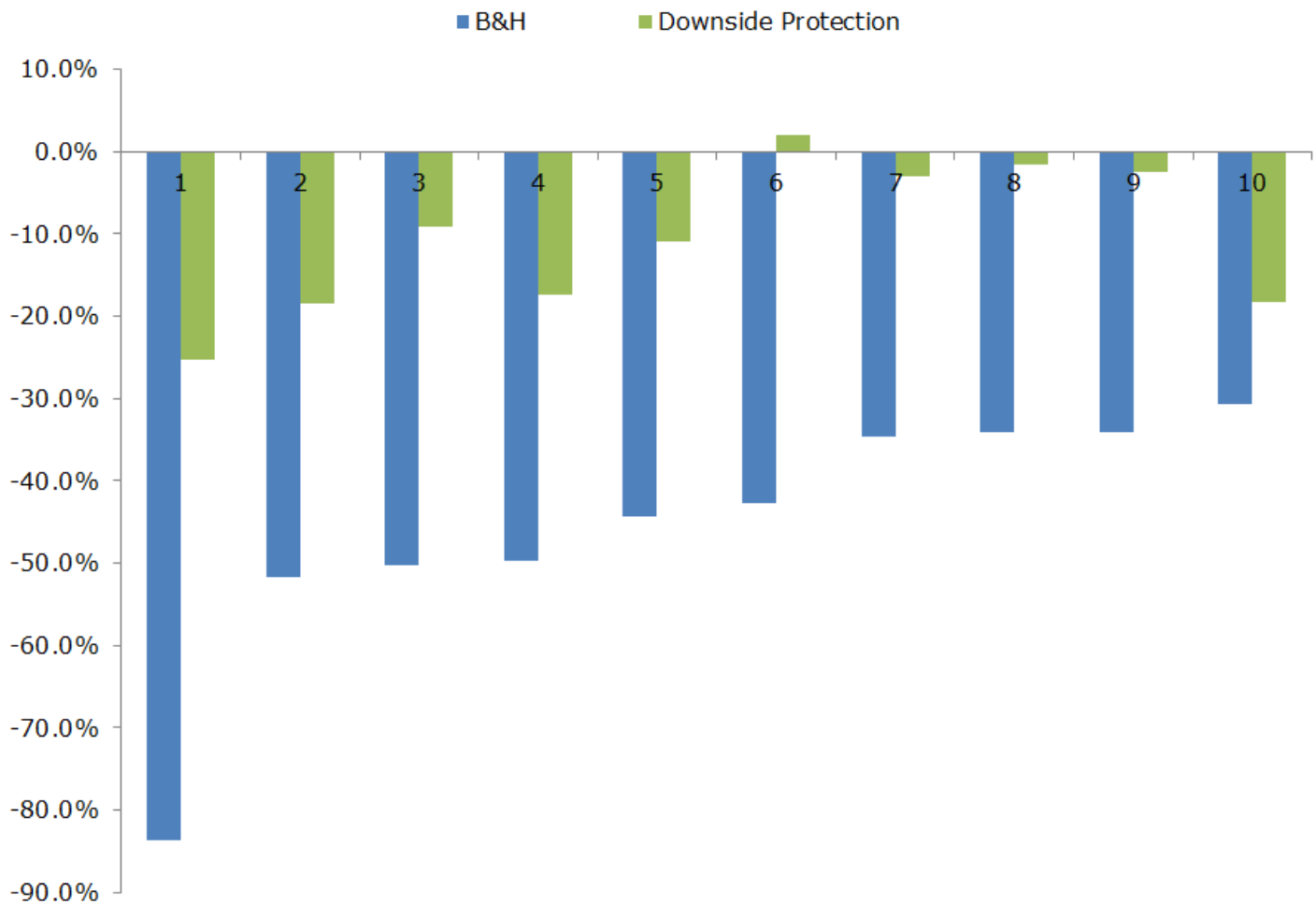
The results are pretty compelling for tail-risk focused investors. Who wouldn't want a system that cuts major market drawdowns in half? What's the catch? Simple: trend rules do not work all the time and are prone to whipsaws. A recent case study is in order: At the end of September 2015 and the end of January 2016, these signals indicated that investors should be out of US stocks. This was a terrible call as the S&P 500 went up ~ 8.44% in October 2015, and went up ~ 6.78% in March of 2016 (signal said to be out both months)! Missing ~ 15% returns in only 2 months is painful! (Note: On the flip side of recent US results, the downside protection rules were highly effective in minimizing large recent drawdowns in emerging equity and commodity markets).

Putting the 3-Step Process together

Here is a summary of the 3-step process:

1. Invest in active global value and momentum equity strategies (preferably concentrated)
2. Overlay the downside-protection model (or something similar)
3. If the downside-protection model is triggered, dynamically hedge the value and momentum equity portfolios with passive equity, moving from a long-only stance to a market-neutral stance.

Digging into the Details of Portfolio Construction

A detailed example helps elaborate how the inner workings of what we will label the Alpha Architect Long/Short (AA L/S) concept.

The portfolio will start with $1.00 in cash. We will use leverage and invest $1.50 into domestic and international value and momentum portfolios. The weights across the four portfolios (US Value, US Momentum, International Value and International Momentum) will be annually assessed and volatility weighted using a 36-month look-back to estimate volatility. We will implement a permanent hedge with a notional value of $0.50 via S&P 500 and EAFE futures contracts (the "hedge") to offset the additional $0.50 exposure to global value and momentum (net market exposure is ~$1.00). In addition to the constant $0.50 hedge, there is a dynamic aspect, which could add an additional $1.00 hedge, or a total of $1.50 notional market hedge against a $1.50 long book, matching the US & International exposure of the portfolio (i.e., market-neutral stance).

How do we determine the dynamic hedge?

We use a combination of momentum and moving average rules (explained here) to time our dynamic market exposures. The dynamic hedge component can either be $0.00, $0.25, $0.50, $0.75, or $1.00 (2 rules for SP 500, 2 rules for EAFE). Thus, the net market exposure for AA L/S can range from 100% (if the dynamic hedge is $0.00) to 0% (if the dynamic hedge is $1.00). Note that when the net exposure is 0%, the portfolio is taking a market neutral (e.g., long/short) bet on the performance of Global Value and Momentum portfolios relative to their passive Index (SP 500 and EAFE).

But why not short individual securities? As we've outlined here, we use index futures to form the short side of the portfolio (expressed via S&P 500 or EAFE in this situation) because of the simplicity (lowers operational risks and costs) and increased potential tax-efficiency.

A word on tax-efficiency of a simple futures-focused short portfolio

Futures, which would be deployed as the short side portfolio exposure, are generally considered 1256 contracts, and any gain or loss is treated for tax purposes as 40% short-term gain and 60% long-term gain. To see the tax efficiency of being short futures versus short individual equities, let's set up a hypothetical scenario where the market declines 30%. If we are hedged using an S&P 500 future, we have a "gain" of 30% by being short the market. The taxes paid are as follows (30% gain)(40% short term)(43.4% top short-term rate + healthcare tax) + (30% return)(60% long term)(23.8% top long-term rate + healthcare tax) = 9.49%, so the after-tax return is 20.51%.

Let's consider an alternative approach where we create a short portfolio consisting of individual stock picks that magically lose to the passive benchmark by 5 percentage points, on average (i.e., short side alpha of ~5%). In our hypothetical scenario, when the market is down 30%, to stock-picking based short portfolio would be down 35%, thus implying a 35% gain for the short manager (assuming costs are zero). What would the tax situation be for this portfolio? Since the short side gains are based on shorting individual stocks (not using futures) they are taxed at short-term rates. Thus, the taxes paid are as follows (35% gain)(100% short term)(43.4% top short-term rate + healthcare tax) = 15.2%, so the after-tax return is 19.8%. Remarkably, even with a 5% "alpha edge," on an after-tax basis, one would be better off hedging with index futures.

Where does this leave us? Because we are taxable investors and need to consider tax-efficient investment solutions, putting the complexity/costs arguments aside, on the basis of taxes alone, getting short exposure via index futures seems like a better approach, in general. Can some hedge fund managers generate magnificent alpha at low-cost and high tax-efficiency on the short side? I'm sure these unicorns exist, but we have never found one and doubt we can in the future.

Great Idea, but How Does this Work in Practice?

To test the idea, we use data from Ken French's website on US and International Value and Momentum portfolios. The underlying data can be found here if one is interested in replicating the idea.

For the US exposures, we used the top decile portfolios for Value and Momentum (value-weight returns).

For international portfolio, which are split 5 x 5 across size and momentum or value, within the top quintile for value and momentum, we average across the top three portfolios on size (we use the value-weight returns).

Below we highlight the returns to the long-only portfolios from the time period of 1/1/1995 to 12/31/2015. The raw data start on 7/1/1990, but having investigated the raw fundamental data that feeds the French data we believe the data quality is marginal prior to 1992. Also, the results start in 1995 because we need to "burn" 3 years to estimate volatility to assess the allocations across value and momentum. For trading costs, we assess a 0.25% transaction cost for each rebalance. For example, the value portfolios are rebalanced annually, so we deduct an annualized 0.25% from these portfolio. The momentum portfolios are rebalanced monthly, so they are assessed an annualized 3% transaction costs (12 rebalances times 0.25% per rebalance). We do not deduct additional management fees from the portfolios, but if one were to outsource this strategy they would need to consider those costs as well. All index returns (EAFE Index, SP 500 Index, and the Risk-Free (RF) rate of Return) are shown gross of any fees or transaction costs.

International Value and Momentum Returns (1/1/1995 – 12/31/2015)

Value and momentum enhance returns relative to the generic EAFE index.

Summary Statistics*	French Int'l Momentum (Net)	French Int'l Value (Net)	EAFE	RF
CAGR	7.21%	6.82%	4.74%	2.54%
Standard Deviation	17.42%	17.87%	16.56%	0.64%
Downside Deviation (MAR=5%)	13.21%	13.24%	12.37%	0.53%
Sharpe Ratio	0.35	0.32	0.21	0.00
Sortino Ratio (MAR=5%)	0.27	0.24	0.08	-4.66
Worst Drawdown	-54.80%	-59.12%	-56.68%	-0.02%
Worst Month Return	-19.06%	-24.86%	-20.18%	-0.01%
Best Month Return	12.43%	16.10%	12.80%	0.56%
Profitable Months	59.52%	54.76%	58.33%	95.63%
Rolling 1-Year Win %	--	56.02%	63.90%	64.73%
Rolling 5-Year Win %	--	41.45%	78.76%	58.55%
Rolling 10-Year Win %	--	20.30%	99.25%	96.24%
Sum (5-Year Rolling MaxDD)	-7572.62%	-6305.59%	-7356.46%	-0.52%

*Returns start in 01/1995 for this strategy.

U.S. Value and Momentum Returns (1/1/1995 – 12/31/2015)

Value and momentum enhance returns relative to the generic equity index, but on a risk-adjusted basis they are similar.

Summary Statistics*	French US Momentum (Net)	French US Value (Net)	SP500	RF
CAGR	9.89%	10.81%	9.65%	2.54%
Standard Deviation	21.83%	21.39%	15.03%	0.64%
Downside Deviation (MAR=5%)	15.73%	16.28%	11.22%	0.53%
Sharpe Ratio	0.43	0.47	0.52	0.00
Sortino Ratio (MAR=5%)	0.44	0.47	0.48	-4.66
Worst Drawdown	-53.01%	-64.62%	-50.21%	-0.02%
Worst Month Return	-24.83%	-28.09%	-16.70%	-0.01%
Best Month Return	22.82%	36.62%	10.93%	0.56%
Profitable Months	60.32%	61.51%	63.89%	95.63%
Rolling 1-Year Win %	--	54.77%	54.77%	70.12%
Rolling 5-Year Win %	--	37.31%	50.78%	61.14%
Rolling 10-Year Win %	--	9.02%	51.13%	81.95%
Sum (5-Year Rolling MaxDD)	-7729.99%	-8028.08%	-6579.38%	-0.52%

*Returns start in 01/1995 for this strategy.

Portfolio Returns (1/1/1995 – 12/31/2015)

Finally, we put the value and momentum pieces together and deploy them using the AA L/S framework described earlier. As outlined above, we assess a 0.25% transaction cost for each rebalance. Since the value portfolios are rebalanced annually, we deduct an annualized 0.25% from these portfolio. The momentum portfolios are rebalanced monthly, so they are assessed an annualized 3% transaction costs (12 rebalances times 0.25% per rebalance). The weights across the four portfolios (US Value, US Momentum, International Value and International Momentum) will be annually assessed on 12/31 and volatility weighted using a 36-month look-back period. We will implement a permanent hedge with a notional value of $0.50 via S&P 500 and EAFE futures contracts (the "hedge"). In addition to the constant $0.50 hedge, there is a dynamic aspect, which could add an additional $1.00 hedge, or a total of $1.50 notional market hedge against a $1.50 long book, matching the US & International exposure of the portfolio. For illustrative purposes, we short the S&P 500 Total Return Index and the EAFE total return Index and not the futures. We deduct an additional 1.49% in management fee costs. Results are net of a +/-0.25% funding spread (i.e., margin costs fed funds plus 25bps and short proceeds receive fed funds minus 25bps). All index returns (50% SP500 Index and 50% EAFE Index, Intermediate-Term US Government Bonds (LTR), and the Risk-Free (RF) rate of Return) are shown gross of any fees or transaction costs.

Here are the core results using French data on value and momentum portfolios:

Summary Statistics*	AA L/S	50% SP500 and 50% EAFE	LTR	RF
CAGR	10.41%	7.29%	7.14%	2.54%
Standard Deviation	14.13%	15.10%	5.98%	0.64%
Downside Deviation (MAR=5%)	9.92%	11.71%	3.73%	0.53%
Sharpe Ratio	0.60	0.38	0.77	0.00
Sortino Ratio (MAR=5%)	0.60	0.27	0.56	-4.66
Worst Drawdown	-28.85%	-53.46%	-6.40%	-0.02%
Worst Month Return	-11.85%	-18.44%	-5.71%	-0.01%
Best Month Return	12.04%	11.11%	8.73%	0.56%
Profitable Months	63.49%	61.90%	64.29%	95.63%
Rolling 1-Year Win %	--	52.70%	58.09%	72.20%
Rolling 5-Year Win %	--	68.91%	77.72%	91.71%
Rolling 10-Year Win %	--	95.49%	96.24%	100.00%
Sum (5-Year Rolling MaxDD)	-3874.19%	-6837.43%	-1078.67%	-0.52%

*Returns start in 01/1995 for this strategy.

Below we examine the correlations across the strategies:

Correlation Matrix	AA L/S	50% SP500 and 50% EAFE	LTR	RF
AA L/S	100.00%	52.76%	-14.16%	3.67%
50% SP500 and 50% EAFE	52.76%	100.00%	-21.14%	1.32%
LTR	-14.16%	-21.14%	100.00%	11.78%
RF	3.67%	1.32%	11.78%	100.00%

**Bold denotes values less than |.5|

Over the past 21 years (1995-2015), which is arguably a short period and thus suggests the results should be taken with a grain of salt, the portfolio performed well relative to buy and hold passive global equities. Moreover, one could argue that the portfolio is not a replacement for a core buy and hold, but rather a complement. When one examines the correlations across the strategies, the AA L/S portfolio has a lower correlation to global equities than a long-only value or momentum portfolio.

Out of Sample: Domestic Portfolio Returns (1/1/1930 – 12/31/1994)

We perform an out-of-sample test of the AA L/S concept from 1930 to 1994. Because of data limitations we focus on U.S. Value and U.S. Momentum portfolios. We assume the same cost estimates as above and annually rebalance the risk-parity weights between U.S. Value and Momentum. The data start in 1927, but we need to burn 3 years of data to compute the initial risk-parity weights. Our out of sample returns run from 1/1/1930 – 12/31/1994. The results are shown below:

Summary Statistics*	AA L/S Domestic	SP500	LTR	RF
CAGR	13.13%	9.46%	4.91%	3.69%
Standard Deviation	23.32%	20.08%	7.26%	0.95%
Downside Deviation (MAR=5%)	17.09%	14.71%	4.63%	0.45%
Sharpe Ratio	0.49	0.37	0.20	0.00
Sortino Ratio (MAR=5%)	0.59	0.41	0.01	-3.05
Worst Drawdown	-79.00%	-81.00%	-20.97%	-0.09%
Worst Month Return	-32.67%	-28.73%	-8.41%	-0.06%
Best Month Return	56.29%	41.65%	15.23%	1.35%
Profitable Months	60.13%	60.51%	62.69%	98.46%
Rolling 1-Year Win %	--	55.66%	63.85%	65.80%
Rolling 5-Year Win %	--	61.58%	80.31%	88.77%
Rolling 10-Year Win %	--	60.97%	86.99%	94.55%
Sum (5-Year Rolling MaxDD)	-22102.77%	-18548.68%	-6545.55%	-7.01%

*Returns start in 01/1930 for this strategy.

The AA L/S strategy generates a strong compound annual growth rate over the buy-and-hold passive index, but also has a whopper of a drawdown and large volatility.

Below we examine the correlations across the strategies and highlight that the AA L/S is likely to serve a diversifying role in a portfolio that is focused on buy-and-hold passive equity as a core component:

Correlation Matrix	AA L/S Domestic	SP500	LTR	RF
AA L/S Domestic	100.00%	53.20%	8.03%	-0.48%
SP500	53.20%	100.00%	18.19%	-2.23%
LTR	8.03%	18.19%	100.00%	12.16%
RF	-0.48%	-2.23%	12.16%	100.00%

**Bold denotes values less than |.5|

Conclusions

The research above highlights the potential power of coupling a trend-based risk management system with generic value and momentum stock-picking algorithms. The long-term results are promising and one could theoretically improve upon the performance of the system by deploying more active value and momentum exposures and/or lowering frictional costs. In the end, the structure appears to be a reasonable portfolio diversifier; however, as is the case with all alternatives, the relative performance risk of these portfolios is substantial (the AA L/S portfolio construct can underperform passive B&H for multi-year stretches). While no one knows what the future may hold, if one believes in value, momentum, and trend, the AA L/S construct seems like a reasonable approach.

For investors seeking an alternative exposure to buy and hold equities, the long/short construct described might be a step in the right direction. Let us know what you think. And if you conduct any replication efforts, please share in the comments section.

Our thoughts:

Our quest to lower Maximum Drawdown for HCM clients that are transitioning to Capital Preservation led us to QMNIX, a Global Long/Short OEF we are already using, and BIICX, a Tactical Allocation OEF focused on Income, with a historical .6 ratio of Maximum Drawdown to that of the S&P 500.

Since a 2% reduction in Worst Drawdown (79% vs. 81% for the SP500) isn't sufficient, we, once again, reached out to Jack:

"A futures hedge when the trend turns negative may allow us to continue to use the IVE System for clients even as they transition to Capital Preservation. So would it be possible to run an analysis on a value/momentum portfolio (50/50), that uses futures to hedge when the trend turns negative using your two criteria?"

Further clarification was necessary:

In your White Paper "you leverage to "a $1.50 long book" "volatility weighted using a 36-month look-back period *(RP)*" with a "constant $0.50 hedge". We wouldn't do any of that, needing to keep it simple for my clients. I need to know what the results would be for a 50/50 value/momentum portfolio, if "we short the S&P 500 Total Return Index and the EAFE total return Index and not the futures" when the trend turns negative. We would have a 1% management fee."

The results for "1992-2015", "Net of transaction fees (as in the blog) and a 1.49% management fee":

Summary Statistics*	AA L/S (domestic)no leverage no RP	AA L/S no leverage no RP	50% SP500 and 50% EAFE	SP500
CAGR	11.29%	9.35%	7.29%	9.22%
Standard Deviation	15.32%	12.36%	14.55%	14.34%
Downside Deviation (MAR=5%)	10.23%	8.84%	11.18%	10.71%
Sharpe Ratio	0.61	0.58	0.38	0.51
Sortino Ratio (MAR=5%)	0.68	0.54	0.28	0.46
Worst Drawdown	-28.08%	-24.15%	-53.46%	-50.21%

Sacrificing 1.35% [13.13% - (11.29% + .49% management fee)] in annual return in order to lower risk to .56 (-28.08%/-50.21%) of the S&P 500's Maximum Drawdown is a trade many investors may be willing to make.