Portfolio Construction Technique: Overlay/Underlay Alternatives Blend

Ranjan Bhaduri, AlphaMetrix Alternative Investment Advisors, Chicago

1. Introduction

Managed futures, a.k.a. CTAs, are a diverse collection of active trading strategies which specialise in liquid, transparent, exchange-traded futures, options, and foreign exchange.

Some institutional investors will consider investing in hedge funds, yet shy away from investing in managed futures. However, the term 'hedge fund' in itself does not mean much, or rather means too much, as there are programs along the entire actively managed investment continuum, from mutual funds to private equity funds that call themselves hedge funds. CTAs may be thought of a liquid sub-set of the hedge funds universe, whose trading domain is exchange-traded instruments of futures, options and deep foreign exchange markets. The strategies, styles, and techniques invoked among different CTAs are very diverse. While there does not appear to be a cogent rationale for the exclusion of CTAs versus hedge funds in their investment mandates, institutional investors still remain wary of the managed futures space. It is further perplexing that these biases exist given that managed futures utilise plain vanilla derivatives and exchange-traded instruments as their building blocks, and these are well-understood in both the literature and industry (see, for instance, Hull or Labusewski, *et al*).

Some CTAs have, from a marketing perspective, positioned themselves away from managed futures, and labeled themselves as hedge funds, in order to attract more assets.[1]

Many industry practitioners seem to have some misconceptions of CTAs, which contributes to unnecessary distinctions and exaggerated differential treatment between CTAs and other hedge funds.

For the sake of simplicity in convention, in this article, 'hedge funds' will refer to 'hedge funds that are not CTAs', though the author readily acknowledges that it is a superior convention to classify CTAs as a sub-set of the hedge funds universe. The main result of this article will demonstrate the folly in those that have a 'CTAs versus hedge funds' mindset, as blending hedge fund investments with investments in CTAs, in an overlay/underlay manner, is a potentially an effective and efficient technique to invoke in portfolio construction.

The road map of this article is quite simple:

1) A brief reconfirmation that adding alternatives to a traditional-only portfolio improves the risk-adjusted return.

2) Getting this alternatives component purely from managed futures was first established by Harvard professor, and co-founder of the CAPM model, John Lintner, in 1983, and continues to hold true. Managed futures have good diversification and liquidity benefits.

3) Using the cash efficiency of managed futures, we introduce the concept of a blend of hedge funds with CTAs via an overlay (CTAs)/underlay (hedge funds) methodology.

4) Different nuances of creating such an alternatives blend are discussed, and statistical analysis and characteristics of the overlay-underlay alternatives blend are examined.

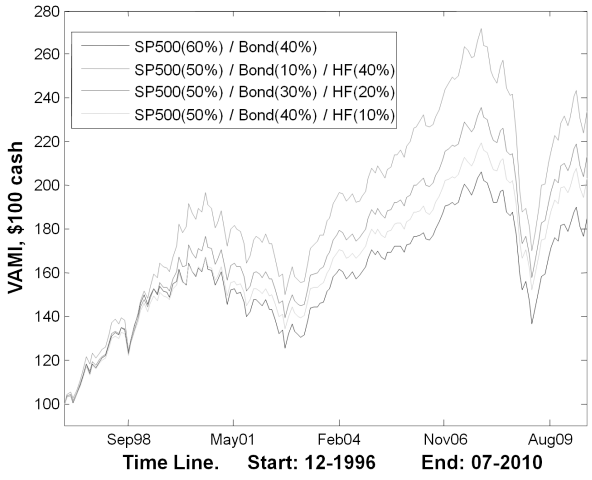
2. Inclusion of alternatives in portfolio

It is well-established in industry literature and practice that adding uncorrelated investments to a traditional portfolio can boost expected returns while reducing portfolio volatility [Anson].

Figure 2.1 illustrates that introducing alternatives leads to a superior result than a traditional-only portfolio, and includes the recent financial and credit crisis of 2007 and 2008. This can be shown via Omega graphical analysis as well (Figure 2.2).

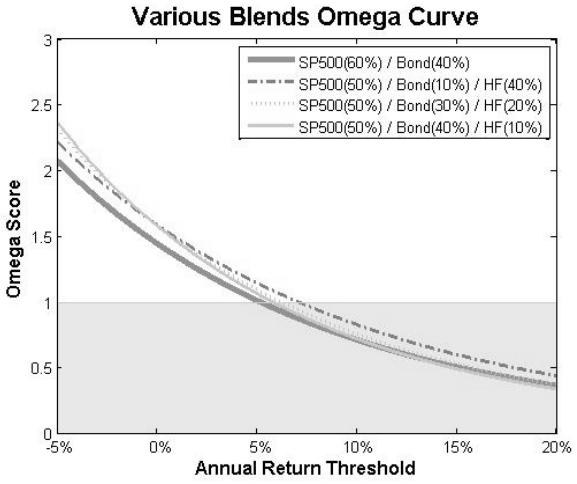
The Omega function and performance measure, co-invented by Con Keating and Canadian mathematician William Shadwick in 2002 [Keating & Shadwick], provides a much better risk-return framework for evaluating alternative investments than the traditional mean-variance approach. The reason is that alternatives typically illustrate non-Gaussian properties [Anson], and the Omega function encodes all of the higher statistical moments. Moreover, the Omega function distinguishes between upside and downside volatility. This article will invoke Omega analysis to help establish points and gain insights.

FIGURE 2.1: Various blends
Common time period: January 1997 – July 2010



Data source: Bloomberg: Barclay CTA, SP500, Barclays Capital Bond Composite US Index; BarclayHedge: Barclay HF

FIGURE 2.2: Incorporating alternatives leads to a dominant Omega graph



3. Importance of the inclusion of managed futures in portfolio construction

Dr. John Lintner may have been ahead of his time. In 1983, Dr. Lintner realised the benefits of the inclusion of alternatives in portfolio construction, and specifically invoked managed futures as the alternatives component. Dr. Lintner did a detailed study in which he finds that portfolios of stocks and/or bonds combined with managed futures show

substantially reduced risk at every possible level of expected return than portfolios of stocks and/or bonds alone. Lintner also finds that the risk-adjusted return of a portfolio of managed futures to be higher than that of a traditional portfolio consisting of stocks and bonds, regardless of the risk appetite of the investor. Portfolio managers who heeded Lintner's advice of including managed futures as a component of their allocations would have suffered less pain during 2008.

TABLE 3.1: The diversification benefits of including managed futures

Performance of the Barclay CTA Index during
15 Worst Quarters of S&P500 Index Performance

Period	Event	S&P 500 Index	Barclay BTOP50 Index	Difference
Q4 1987	Black Monday — Global Stock Markets Crash	-23.23%	16.88%	40.11%
Q4 2008	Bear Market in US Equities led by Financials	-22.56%	8.73%	31.29%
Q3 2002	WorldCom Scandal	-17.63%	9.41%	27.05%
Q3 2001	Terrorist Attacks on World Trade Center and Pentagon	-14.99%	4.12%	19.10%
Q3 1990	Iraq Invades Kuwait	-14.52%	11.22%	25.74%
Q2 2002	Continuing Aftermath of Technology Bubble Bursting	-13.73%	8.52%	22.26%
Q1 2001	Bear Market in US Equities led by Technology	-12.11%	5.97%	18.08%
Q2 2010	European Sovereign Debt Crisis, 'Flash Crash' in US Equities	-11.86%	-1.92%	9.94%
Q3 1998	Russia Defaults on Debt, LTCM Crisis	-10.30%	10.54%	20.84%
Q1 2008	Credit Crisis, Commodity Prices Rally	-9.92%	5.91%	15.83%
Q3 2008	Credit Crisis, Government-Sponsored Bailout of Banks	-8.88%	-3.71%	5.17%
Q4 2000	DotCom Bubble Bursts	-8.09%	19.78%	27.87%
Q3 1999	Anxiety during run up to Y2K	-6.56%	-0.67%	5.89%
Q1 1994	Federal Reserve begins increasing Interest Rates	-4.43%	-2.10%	2.33%
Q4 2007	Credit Crisis, Subprime Mortgage Losses	-3.82%	3.02%	6.84%

Source: AlphaMetrix Alternative Investment Advisors, Bloomberg

Astute finance scholars have produced compelling studies that further support and complement Dr. Lintner's work. For instance, William Fung and David Hsieh demonstrated via an options framework that trend-followers can reduce the volatility of a typical stock and bond portfolio during extreme market downturns [Fung & Hsieh 2001]. Trend-followers form roughly two-thirds of the managed futures space [Abrams-Bhaduri-Flores]. Harry Kat, in a very fine paper, illustrates that managed futures allow investors to achieve a very substantial degree of overall risk-reduction with limited costs [Kat]. Kat's work includes statistical analysis focusing on the first four statistical moments, and demonstrates that combining hedge funds and CTAs is beneficial. He aptly titled his paper '*Managed Futures and Hedge Funds: A Match Made in Heaven.*' Kat's work was published in the beginning of 2004. Obviously, much has happened in the capital markets since 2004, but this article will show that the kernel of Kat's results still hold true, and it is unfortunate that more allocators with a fiduciary duty have not heeded the insights of Kat's 2004 paper.

The liquidity benefit of managed futures should be very much appreciated. From a behavioural finance and game-theoretic perspective, it has been shown that humans tend to underestimate the value of liquidity [Bhaduri & Whelan]. Even before the financial meltdown, it had been demonstrated via liquidity buckets that hedge funds with less liquidity were not being paid sufficiently to take on illiquidity [Bhaduri & Art]. Indeed, investors who claim that they do not need liquidity as they have a long time horizon are failing to realise that that is not a justification for being paid less than they should for taking on the additional liquidity risk. Moreover, liquidity and model risk are entangled, in that there are fewer hidden risks when trading liquid instruments (there are no valuation or accounting issues for instruments on the CME or Montreal Exchange). Model risk gets magnified with illiquid investments, which was demonstrated during the credit and financial crisis of 2008. Intelligent and sophisticated portfolio managers realise the profound importance of liquidity. It's not surprising, therefore, that Daniel MacDonald, portfolio manager of alternative investments for the world-class and well-respected Ontario Teachers Pension Plan has stated that 'liquidity is the first line of defense'.

4. Alternative blend rationale and implementation

Cash efficiency of managed futures

In contrast to managed futures, equity hedge fund leverage requires borrowing funds at a rate at or above LIBOR. Managed futures investing allows for the efficient use of cash made possible by the low margin requirements of futures contracts. Rather than allowing cash not being used for margin to collect interest at the investor's futures commission merchant, the investor can deploy it to gain a higher notional exposure when investing using a managed account or managed account platform; consequently, the investor is not paying interest, since they did not need to borrow money to get this extra exposure.

The following example helps to highlight the important point that cash efficiency of managed futures is not a form of traditional leverage. Recall that in traditional leverage, one borrows money, pays interest for the borrowed money, and deploys the borrowed money into an investment. Using the inherent cash efficiency of futures, the investor may obtain higher notional exposure than the cash amount deployed, without an extra charge.

Example one

Suppose an institutional investor has $50 million cash, and wishes to get $50 million exposure in a managed futures strategy that allows for a funding factor of two via an investment through a managed account platform.

Then the investor only needs to invest $25 million (= (50 ÷ 2)) to the managed futures strategy. The $25 million investment would be able to obtain $50 million of exposure to the strategy; the investor would have to pay fees on $50 million, but may put the other $25 million of the original $50 million in Treasury Bills to receive interest. Assuming that the managed accounts platform is using a limited liability structure, the absolute worst case scenario for this investor would be to lose $25 million (ie, the cash amount actually deployed in the managed futures strategy). Thus, the worst case scenario in managed futures via utilising the cash efficiency of futures is not as damaging as if the intrinsic cash efficiency embedded in futures was not present.

The cash efficiency that is embedded with futures trading is essential in the portfolio construction of creating overlay-underlay blends. A critical component of gaining the cash efficiency is to invest in the managed futures either via a separate managed account vehicle or through a managed account platform.

A critical component of gaining cash efficiency is to invest in managed futures either via a separate managed account vehicle or through a managed account platform. It should be noted that significant operational expertise and technological infrastructure is required to properly handle a separate managed account.

The portfolio construction of the overlay/underlay blend of alternatives is allocating a certain amount of cash to hedge funds (underlay) and the remainder of the cash to CTAs (overlay) via a managed account or managed account platform in order to enjoy the cash efficiency of managed futures. This means that the cash allocation to CTAs will be less than the notional exposure of the CTAs.

Example two

Suppose an institutional investor has $50 million cash, and wishes to invest in an overlay/underlay blend of alternatives. Suppose that the investor invests $35 million in hedge funds. This would leave $15 million cash to be invested in managed futures;

assume that the cash efficiency of the managed futures investment translates to a funding factor of 2. This means that the investor would receive $30 million (= $15 *2) of notional exposure to the CTA (or portfolio of CTAs). The investor is thus gaining $65 million exposure to alternatives, but only deployed $50 million and did not borrow money and so is not paying interest.

Failure to properly construct the portfolio will obviously lead to very poor results. The overlay/underlay blend of alternatives should not be mistaken for portable alpha.[2]

It is important to conduct rigorous due diligence of the underlying investments and truly understand the risks. The overlay/underlay blend of alternatives allows for many different types of portfolio construction. The remainder of this section briefly highlights some nuances and ideas that may serve as catalysts for portfolio construction using the overlay/underlay blend of alternatives technique.

Remarks

a) The overlay portion to managed futures, if done correctly, is a form of liquid alpha. The fact that CTAs are trading liquid instruments allows for the many advantages of liquidity (such as rebalancing, tactical asset allocation congruent to the changing dynamic economic landscape). To that end, having the underlay portion in liquid alpha strategies makes sense. Consequently, market-neutral equity and statistical arbitrage are two hedge fund strategies which would lend themselves to consideration in overlay-underlay portfolio construction. This is especially true if the objective is to be uncorrelated with the traditional, non-alternative investments. Long-short equity, some liquid commodity/natural resources and some global macro hedge funds also might fit into the underlay category, while FX managers are also candidates for the overlay portion.

b) The cash efficiency of managed futures should comfortably allow for funding factors of 2 or 3, but of course prudent attention must be given in setting and monitoring the calibration. Diversified trend-followers would tend to have funding factors of 2 (as opposed to 3), and short-term traders in the managed futures space in general will allow for more cash efficiency (funding factor of 3). This allows for interesting portfolio constructions.

c) Having emerging hedge funds in the underlay with emerging CTAs in the overlay is also a potentially effective application of the overlay-underlay alternatives blend. The biggest drawback of emerging managers in general is perhaps the lack of operational infrastructure. However, invoking the overlay-underlay alternatives blend requires operational excellence. Consequently, via separate managed accounts or a managed accounts platform, an extra layer of governance is invoked. Furthermore, the cash efficiency of the overlay portion may increase via cross-margining the emerging CTAs in a single account.

d) If the underlay portion is in credit hedge fund strategies, then having the overlay with short-term trading CTAs might be a good complement. This is because, in a very general way, if there is less risk-aversion sentiment and activity in the markets, this tends to be good for credit hedge fund strategies and less ideal for short-term trading CTAs (since the volatility of the markets may be less). While if risk-aversion increases, then the volatility increases which may provide a better opportunity for some short-term CTAs, while making it a potentially more challenging environment for credit strategies. Thus blending credit strategies with short-term trading CTAs is one potential approach for the overlay-underlay approach.

e) From an options perspective, some hedge funds are often long gamma while some CTAs may be short gamma. Therefore, the proper blending in the overlay/underlay alternatives portfolio construction may give a better possibility of an 'all-weather' type of portfolio.

f) Interestingly enough, some hedge funds that trade both futures and equities (or some other types of investments), may internally be invoking a methodology of the overlay/underlay portfolio construction.

5. Results

The previous section gave the rationale for the overlay-underlay alternatives blend methodology. In this section, we will see some results applied to hedge fund and CTA indices. We will examine the cases where the funding factor is 2, and where the funding factor is 3.

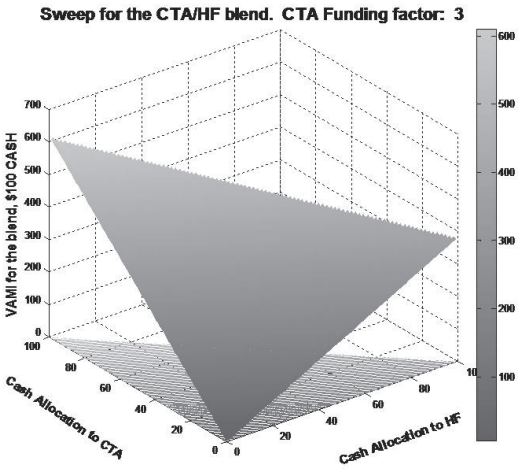
5.1. Funding Factor of 2

If the decision to allocate $100 million of cash to alternatives has been made, using the overlay-underlay alternatives blend technique, then one has to decide how much cash to allocate to the underlay (hedge funds) and how much to the overlay (CTAs). There are numerous possibilities, and in order to help select a proper blend, one could utilise the quantitative technique of 'sweeping' through all possibilities, as seen below.

Figure 5.1.1 illustrates that the VAMI seems to be in a fairly tight range across all blends with no slack (ie, slack refers to cash that is not utilised for either the overlay or underlay).

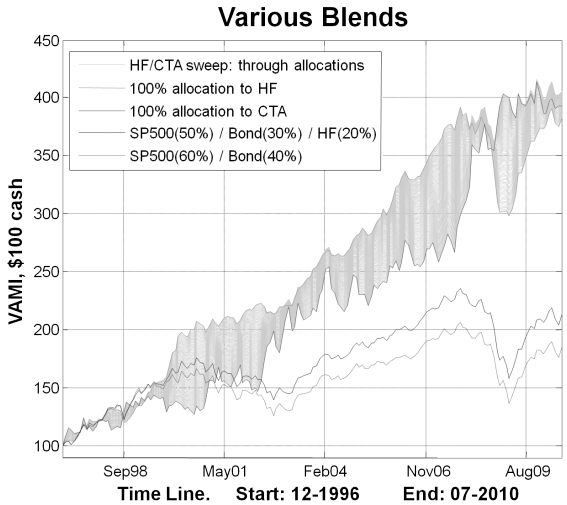
Figure 5.1.2 illustrates that a 100% allocation to hedge funds was dominating any overlay/underlay blend, until the recent financial meltdown, at which time a 100% allocation to CTAs beat all the other blends. Observe, however that at the end of the time period, it is a blend that is beating either a pure allocation to hedge funds or a pure allocation to CTAs. Instituting a proper blend seems to provide good protection against a very tough environment without sacrificing the upside potential. The statistics in Table 5.1.3 will examine some specific blends.

FIGURE 5.1.1:
Blend of Barclay CTA and Barclay Hedge Fund Indices, using a funding factor of 2 for the Barclay CTA index



Timeframe: January 1997 to July 2010

FIGURE 5.1.2



Notice that the blends, in comparison to the pure hedge funds allocation have similar return and standard deviation properties, but the skew and kurtosis are better behaved in the blends (which also have substantially less severe draw downs than the pure hedge funds allocation). This is also reflected in Figure 5.1.4 in the Omega graphs. The more that the CTA exposure is increased, the more these characteristics (less severe draw downs, positive skew, less of a fat tail, less correlation to the traditional asset classes) become present.

TABLE 5.1.3

	S&P 500	Barclay Bond Global	Barclay Hedge Fund	Barclay CTA	CTA/HF 10/95	CTA/HF 66/67	CTA/HF 100/50
Annualised return	2.96%	6.24%	10.38%	5.45%	10.46%	10.77%	10.85%
Annualised standard deviation	16.61%	4.05%	7.72%	7.34%	7.39%	7.16%	8.36%
Skew	-0.65	0.08	-0.70	0.29	-0.55	0.18	0.24
Kurtosis	3.65	3.66	6.20	3.32	5.60	2.93	2.95
Omega (10%)	0.79	0.54	1.07	0.67	1.08	1.10	1.10
Robustness (10%)	0.97	0.92	0.90	0.94	0.90	0.90	0.92
Positive months	97	113	117	91	113	103	101
Negative months	66	48	46	72	50	60	62
Average positive return	3.47%	1.09%	1.86%	1.91%	1.89%	2.11%	2.36%
Average negative return	-4.20%	-0.82%	-1.71%	-1.36%	-1.48%	-1.23%	-1.50%
Largest drawdown	-52.56%	-3.59%	-24.09%	-7.74%	-21.80%	-12.53%	-8.68%

FIGURE 5.1.4

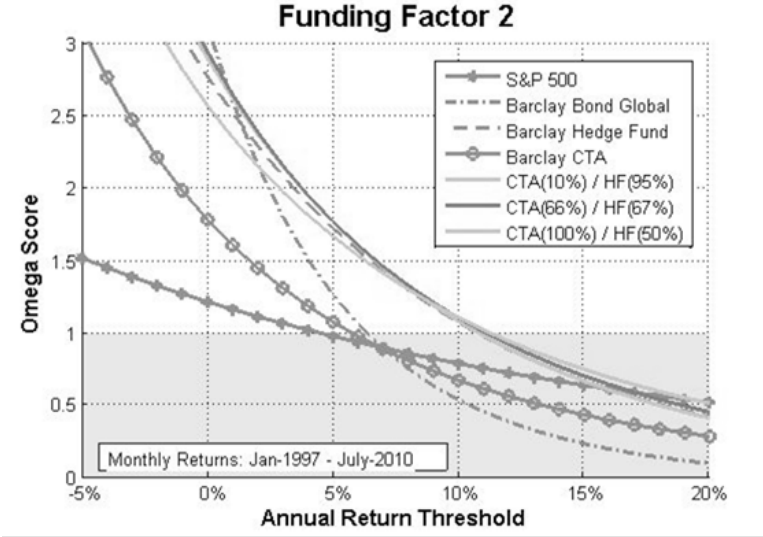


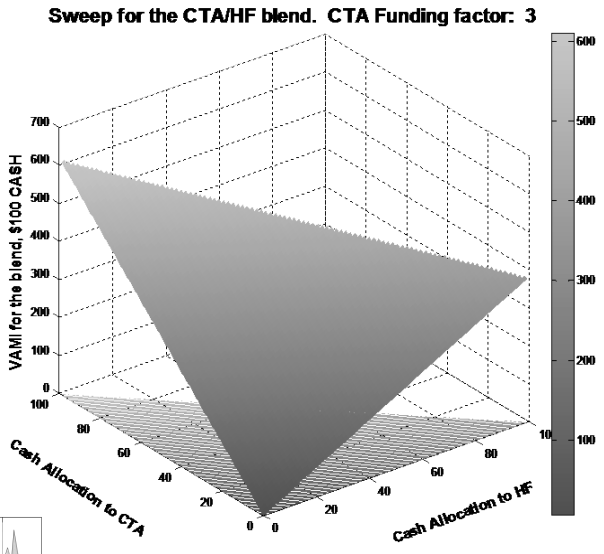
TABLE 5.1.5: Correlation matrix (January 1997 to July 2010)

	S&P500	Barclay Bond Global	Barclay Hedge Fund	Barclay CTA	CTA/HF 10/95	CTA/HF 66/67	CTA/HF 100/50
S&P500	1.00	0.01	0.76	-0.13	0.74	0.46	0.23
Barclay Bond Global	0.01	1.00	-0.01	0.27	0.02	0.18	0.24
Barclay Hedge Fund	0.76	-0.01	1.00	0.02	1.00	0.74	0.48
Barclay CTA	-0.13	0.27	0.02	1.00	0.12	0.69	0.89
CTA/HF (10/95)	0.74	0.02	1.00	0.12	1.00	0.80	0.56
CTA/HF (66/67)	0.46	0.18	0.74	0.69	0.80	1.00	0.95
CTA/HF (102/49)	0.23	0.24	0.48	0.89	0.56	0.95	1.00

5.2: Funding factor of 3

The funding factor of 3 means that the cash efficiency of the overlay portion increases. The return of the blend increases substantially, as does the volatility. However, the blends contain more upside volatility, which is why the drawdowns of the blends are less severe than the pure hedge fund allocation and the Omega score at a 10% annualised threshold are higher for the blends.

FIGURE 5.2.1



Timeframe: January 1997 to July 2010

FIGURE 5.2.2

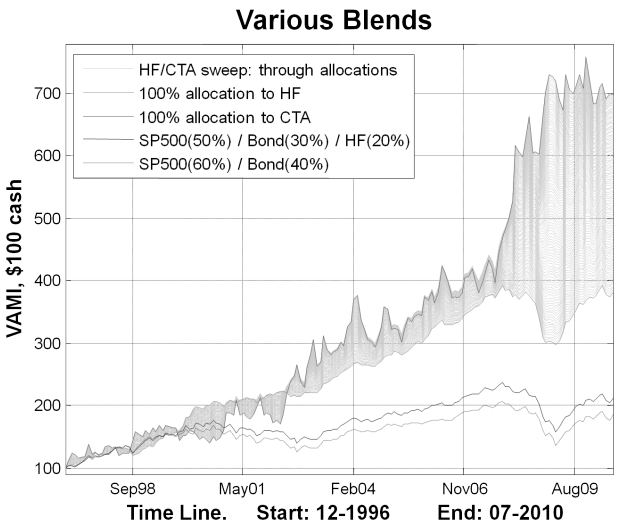


TABLE 5.2.3

	S&P 500	Barclay Bond Global	Barclay Hedge Fund	Barclay CTA	CTA/HF 120/60	CTA/HF 15/95	CTA/HF 270/10
Annualised return	2.96%	6.24%	10.38%	5.45%	13.06%	10.76%	15.14%
Annualised standard deviation	16.61%	4.05%	7.72%	7.34%	10.03%	7.44%	19.84%
Skew	-0.65	0.08	-0.70	0.29	0.24	-0.47	0.28
Kurtosis	3.65	3.66	6.20	3.32	2.95	5.30	3.28
Omega (10%)	0.79	0.54	1.07	0.67	1.27	1.11	1.28
Robustness (10%)	0.97	0.92	0.90	0.94	0.92	0.90	0.96
Positive months	97	113	117	91	101	113	93
Negative months	66	48	46	72	62	50	70
Average positive return	3.47%	1.09%	1.86%	1.91%	0.03	1.92%	5.15%
Average negative return	-4.20%	-0.82%	-1.71%	-1.36%	-0.02	-1.48%	-3.71%
Largest drawdown	-52.56%	-3.59%	-24.09%	-7.74%	-10.36%	-21.19%	-20.06%

FIGURE 5.2.4

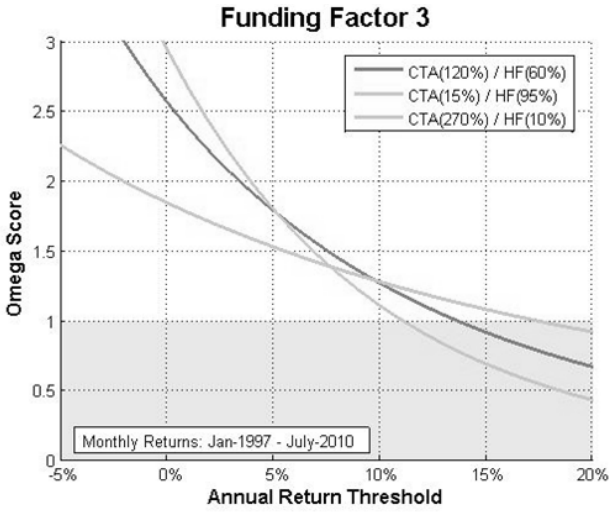


TABLE 5.2.5

	S&P500	Barclay Bond Global	Barclay Hedge Fund	Barclay CTA	CTA/HF 15/95	CTA/HF 120/60	CTA/HF 270/10
S&P500	1.00	0.01	0.76	-0.13	0.73	0.23	-0.10
Barclay Bond Global	0.01	1.00	-0.01	0.27	0.03	0.24	0.27
Barclay Hedge Fund	0.76	-0.01	1.00	0.02	0.99	0.48	0.06
Barclay CTA	-0.13	0.27	0.02	1.00	0.17	0.89	1.00
CTA/HF (15/95)	0.73	0.03	0.99	0.17	1.00	0.60	0.21
CTA/HF (120/60)	0.23	0.24	0.48	0.89	0.60	1.00	0.90
CTA/HF (270/10)	-0.10	0.27	0.06	1.00	0.21	0.90	1.00

6. Conclusion

The properties of the overlay/underlay alternatives blend in comparison to the pure hedge funds allocation should be appealing to allocators such as pensions and endowments. Less severe draw downs, less correlation to traditional asset classes, somewhat higher return potential and a more positive skew with less fat tails seem to be the result when examining this technique through appropriate indices.

The statistics in Table 6.2 (on the following page) also illustrate how the blend leads to slightly higher returns and less severe draw downs. Notice that these differences would be more pronounced, had the allocation to alternatives been higher than 20%.

FIGURE 6.1.1

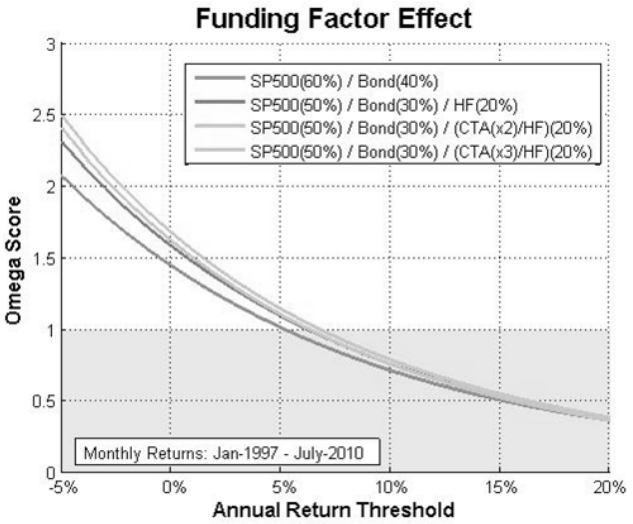


TABLE 6.2

	SPX / Bond 60% / 40%	SPX / Bond / HF 50 / 30 / 20	SPX/Bond/ (CTA(x2)/HF) 50 / 30 / 20	SPX/Bond/ (CTA(x3)/HF) 50 / 30 / 20
Annualised return	4.64%	5.73%	5.84%	6.33%
Annualised standard deviation	10.12%	9.62%	9.18%	9.15%
Skew	-0.60	-0.71	-0.58	-0.48
Kurtosis	3.63	3.93	3.51	3.26
Omega (10%)	0.71	0.76	0.76	0.79
Robustness (10%)	0.95	0.95	0.95	0.94
Positive months	98	103	99	100
Negative months	65	60	64	63
Average positive return	2.28%	2.17%	2.19%	2.21%
Average negative return	-2.38%	-2.35%	-2.09%	-2.09%
Largest drawdown	-33.89%	-33.06%	-30.35%	-28.88%

Allocators who choose not to invest in managed futures should be forced to justify their reasoning in a rigorous fashion since blending CTAs with hedge funds is potentially a powerful combination. The liquidity and cash efficiency benefits of the overlay (CTAs) portion, and the diverse set of combinations to apply the overlay-underlay alternatives blend techniques arm the talented portfolio manager with a large arsenal of effective tools.

Ranjan Bhaduri
PhD CFA CAIA MMath MBA
Chief Research Officer
AlphaMetrix Alternative Investment Advisors, LLC
Tel: 312.267.8444
rbhaduri@AlphaMetrix.com

Edgar Lobachevskiy
PhD MFE
Quantitative Associate
AlphaMetrix Alternative Investment Advisors, LLC
elobachevskiy@AlphaMetrix.com

Endnotes:

The authors would like to thank Aleks Kins, Charley Penna, Benjamin Williams, Josh Horton, Randy Warsager, and Daniel MacDonald.

1. An amusing (though sad) incident related to me by an industry colleague who had a meeting with a US public pension in 2006. He was told by the CIO that the pension invested in hedge funds, but would not invest in CTAs. When shown the hedge funds that this pension were invested in, the first on the list (which was listed alphabetically) was Bridgewater; the punch-line of course is that Bridgewater was a CTA and, in 2006, was even a constituent of the Barclay BTOP 50 CTA Index.

2. During the 2008 financial meltdown, many portfolio managers invoked portable alpha strategies. Portable alpha was a 'clever' way for portfolio managers to try and beat their mandate. For instance, a PM who has been mandated to gain exposure to the S&P 500 might try and gain that exposure via S&P 500 Futures (and continue to maintain that exposure by rolling the futures) and due to the cash efficiency of futures, could then deploy the cash in a 'low-vol' market-neutral fund of hedge funds that aimed for a modest return (usually LIBOR + 400 to 600 basis points). However, those funds of funds which failed to conduct rigorous due diligence fell into the trap of illiquid hedge funds that did not generate true alpha. The architecture of portable alpha also has an inherent potential risk-budgeting mismatch since the risk of a pure beta strategy (whether

gained via equities or futures) is less than the complexities and nuances of the illiquid hedge funds that typically accompanied a portable alpha strategy. The overlay-underlay alternatives blend stays strictly with alternatives; consequently it is easier and cleaner to invoke a risk-budgeting process.

References

Abrams, Ryan, Ranjan Bhaduri, and Elizabeth Flores. 'Lintner Revisited —- A Quantitative Analysis of Managed Futures in an Institutional Portfolio'. CME Group Publication, June 2009.

Anson, Mark. *The Handbook of Alternative Assets*. Wiley Finance, 2002.

Bhaduri, Ranjan and Christopher Art. 'Liquidity Buckets, Liquidity Indices, Liquidity Duration, and their Applications to Hedge Funds.' *Alternative Investment Quarterly*, Second Quarter, 2008.

Bhaduri, Ranjan and Niall Whelan. 'The Value of Liquidity'. *Wilmott Magazine,* January 2008.

Fung, William, and David Hsieh. 'The Risk in Hedge Fund Strategies: Theory and Evidence from Trend Followers'. *The Review of Financial Studies,* Summer 2001, Vol. 14, No. 2, pp. 313 - 341.

Hull, John. *Options, Futures, & Other Derivatives*, 7th edition. Prentice Hall, 2008.

Kat, Harry. 'Managed Futures and Hedge Funds: A Match Made in Heaven'. *Journal of Investment Management*, Vol. 2, No. 1., (2004), pp 1-9.

Keating, Con and William F. Shadwick. 'A Universal Performance Measure.' The Finance Development Centre, 2002.

Labuszewski, John, John Nyhoff, Richard Co, and Paul Peterson. *The CME Group Risk Management Handbook — Products and Applications*. Wiley Finance, 2010.

Lintner, John. 'The Potential Role of Managed Commodity-Financial Futures Accounts (and/or Funds) in Portfolios of Stocks and Bonds.' *The Handbook of Managed Futures: Performance*, Evaluation & Analysis. Ed. Peters, Carl C. and Ben Warwick. McGraw-Hill Professional, 1996. 99-137.

MacDonald, Daniel. Personal communication and shared with permission. (2009)