An Alternative Investment Specialist

CAN ONE HEDGE THE TAIL RISK OF A FUND OF FUNDS?

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SUMMARY

We examine a broad variety of strategies intended to protect a fund of funds from downside risk, focusing on the protection provided by investing in particular types of hedge funds themselves as well as in overlays using commodities and credit or volatility derivatives.

We find that downside risk is not a single thing. Historically, different strategies have been helpful hedges at different times. Allocations to CTA or Macro hedge funds would have been effective during prolonged momentum-driven crises. Gold and oil investments have been of more occasional help. CDS trading would have been useful in crises involving sovereign and corporate default risk. Volatility overlays generally provide the most generic downside protection, because rising market volatility is often a hallmark of impending and realized crises, Unfortunately, the cost of continual volatility exposure is prohibitive unless you can hedge at the right time. We note that third-quartile (high but not enormous) VIX levels often foreshadow impending crises and that S&P puts bought during those periods have provided good statistical protection at low net cost.

We conclude that there is no panacea for hedging crises. To truly protect a portfolio against downside risk requires buying insurance against all its known manifold risks, plus other yet unimagined ones. Though tactical protection appropriate to the type of crisis can help, it requires timing, which is difficult. In practice, there is no substitute for careful due diligence, understanding specialist strategies and their strong and weak points, and skilled diversification that avoids concentration and risk and style overlap.

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1. HEDGE FUNDS AND TAIL RISK

A fund of hedge funds is a portfolio consisting of a variety of hedge funds trading a variety of strategies. Hedge funds have historically tended to present themselves as "market-neutral" or providing "absolute return," a fata morgana that shouldn't be taken 100% seriously. There are crises, especially liquidity crises, which affect everything you can trade, mostly for worse. Starting in 2008, when broader markets fell precipitously, the HFRI Fund of Funds Composite Index (HFRI for short, henceforth) fell too. Nevertheless, the HFRI's decline during this period, compared with that of the S&P 500 in Figure 1, was much more muted.

Figure 1: HFRI Fund of Funds Composite Index vs. the S&P 500, Jan 2006 – May 2011. Index normalized to 100 in Jan 2006.
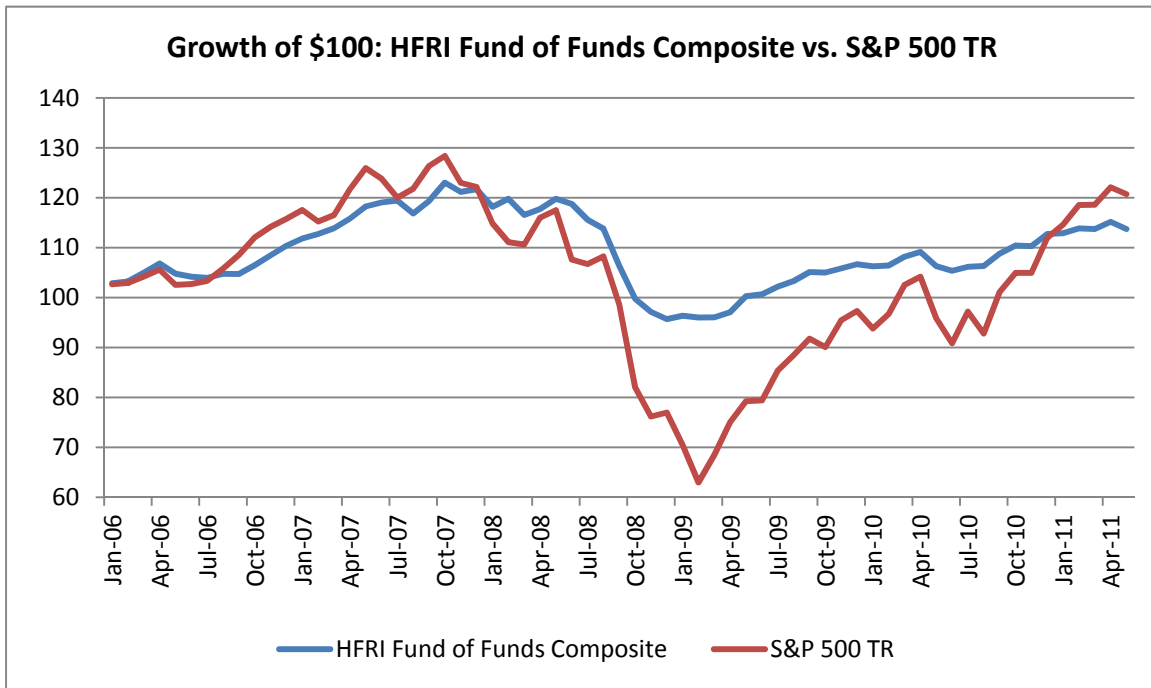
Growth of $100: HFRI Fund of Funds Composite vs. S&P 500 TR

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac

In recent years a sequence of sharp and unexpected market declines has led to the idea of avoiding so-called "tail" or "downside" risk becoming fashionable. Since investors often look to hedge funds as a way of avoiding conventional market losses, the notion of seeking protection against downside risk for funds of funds has drawn attention too.

In this report we investigate the possibility of hedging downside risk for a fund of funds. In Section 2 we examine the effect of previous financial crises on the HFRI. Section 3 discusses the typical behavior of investors during crises, and the effect such behavior has on the market. One common characteristic of crises is increased volatility, and so Section 4 examines the volatility sensitivity of hedge funds in crises. Section 5 proposes a scale for measuring protection; we define a numerical metric for quoting the benefit and cost of a hedge for downside risk, so that we can compare different strategies.

We then divide possible protection strategies into three classes: hedge funds themselves as a form of protection, overlay positions involving other physical securities, and credit defaults swaps and volatility derivatives. We propose using 5% of NAV annually as a reasonable allocation to protection strategies. Section 6 examines the protection afforded by hedge funds themselves, while Section 7 examines the protection from commodity overlays. Section 8 looks at the use of credit default swaps as hedged for a fund of funds. Lastly, Section 9 covers what we believe to be the most promising general protection strategies, volatility-linked derivatives employed continuously as well as timed to coincide with periods of rising volatility.

In Section 10 we present a summary table of the protection provided by the various approaches. We conclude that most individual hedge funds provide too little bang for the buck in this context, though CTA as a class may provide some protection during prolonged downdrafts. Commodity overlays and credit default swaps are unreliable unless you can tactically anticipate the nature of a crisis. Long volatility positions are the best strategy for hedging generic downside risk. Unfortunately but unsurprisingly, the cost of volatility exposure is prohibitive unless one can predict impending crises. We find that third-quartile (high but not enormous) VIX levels may serve as a statistical signal of impending market declines, and may be worth trying.

None of these tactics mitigates the need for careful due diligence and skilled unconcentrated diversification among specialist strategies.

2. A LOOK AT HEDGE FUNDS DURING MARKET CRISES

Figure 2 displays the HFRI Fund of Funds Composite Index from Jan 1990 to May 2011, with periodic drawdowns highlighted in yellow. Each of these periods involved financial crises, but each one was different:

- The crisis in 1994 was a fixed-income blow-up, a sudden rise in interest rates associated with the collapse of the CMO market.
- The Russian default / Long Term Capital Management crisis of 1998 was characterized by a widening of credit spreads and a contagious flight to quality.
- The early 2000s, an era of negligible returns, reflected the bursting of the internet stock bubble, soon to be followed by 9/11.
- The 2008 financial crisis witnessed the collapse of the mortgage market, its consequences for the banking sector that owned mortgage securities, a panicky flight to liquidity and safety in which margin calls transmitted declines from illiquid markets to liquid ones, as well as a severe and sustained decline in the economy.
- The brief decline in the HFRI in May 2010 was associated with the "flash crash", the BP oil spill, and the rioting in Greece. The flash crash was largely technical; the equity market jumped sharply down and then recovered with few economic consequences.
- The 1987 stock market crash, not shown on this graph, was also a largely technical event, confined almost entirely to equity markets, with little sustained economic consequences.

Figure 2: HFRI Fund of Funds Composite Index, Jan 1990 – May 2011. Index normalized to 100 in Jan 1990.

Growth of $100: HFRI Fund of Funds Composite
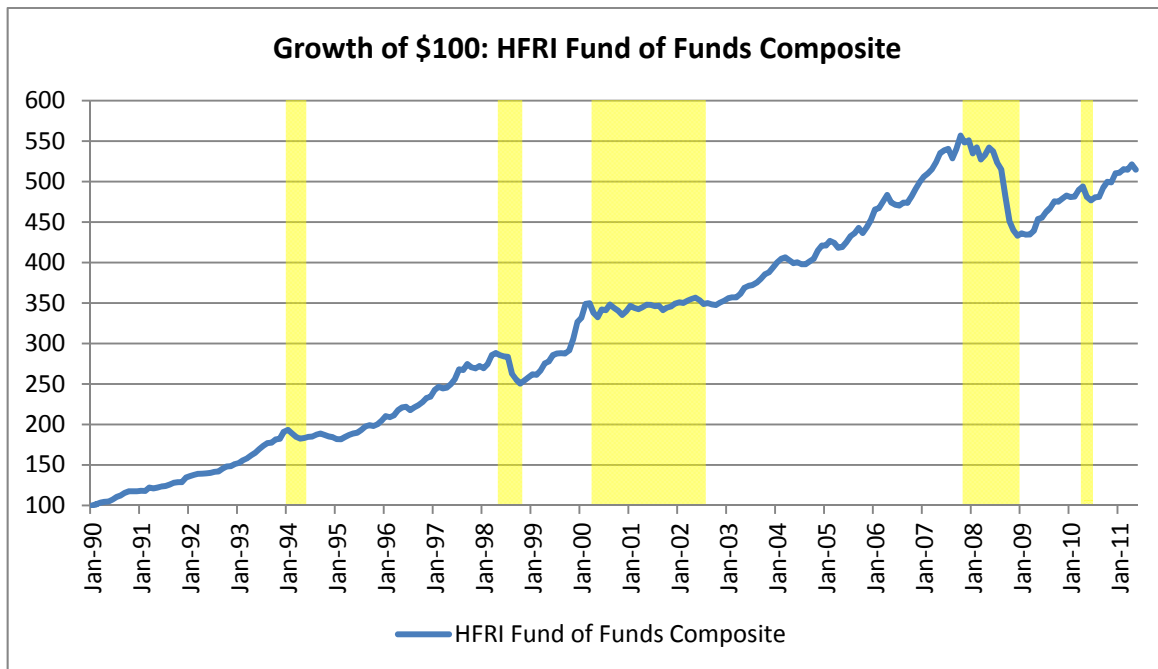
Source: PerTrac

Our point is that there is no generic market crisis. Some are short and intense, like the flash crash. Others are prolonged and proceed with momentum. Different financial problems cause different types of decline, which, though they may look similar on a graph of returns, have different underlying causes. The most damaging declines are those with broad economic consequences.

At this time investors fear other potential tail events: consequences of credit downgrades of AAA countries, runaway inflation caused by successive bursts of quantitative easing, the stagflation that may accompany it, a Japan-style decade of no growth in the U.S. caused by the reluctance to recognize and resolve insolvencies, as well as further flights from illiquidity triggered by sovereign defaults in Europe.

As Krugman and Wells point out[2], the busts have gotten bigger each time, and calling them rare and unforeseen events that nevertheless occur about every half-decade may well be a misnomer.

3. WHAT HAPPENS DURING FINANCIAL CRISES

Although no two crises are alike, investors' responses to the threat of dramatic and widespread loss have many common features, among them one or more of the following:

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[2] *The New York Review of Books, July 14, 2011: http://www.nybooks.com/articles/archives/2011/jul/14/busts-keep-getting-bigger-why/*

- A preference for cash or short-term Treasuries[3];
- A preference for precious metals;
- A flight to perceived simplicity;
- A flight to perceived quality;
- Avoidance of perceived illiquidity;
- Avoidance of credit risk;
- Increase in realized and implied volatilities;
- Increase in volatility skew; and
- Increase in correlation across securities and asset classes

These features suggest various strategies for downside protection that we will investigate in this report.

4. THE VOLATILITY SENSITIVITY OF HEDGE FUNDS DURING MARKET CRISES

Almost all of the characteristic features of crises, listed above, are correlated with increases in equity index short-term implied volatility, as measured, for example, by the VIX. Figure 3 shows the VIX plotted together with the total return growth of the S&P 500. Notice that the highlighted crisis periods in Figure 2 correspond closely to periods of high VIX levels.

Figure 3: S&P 500 Total Return and the level of the VIX.
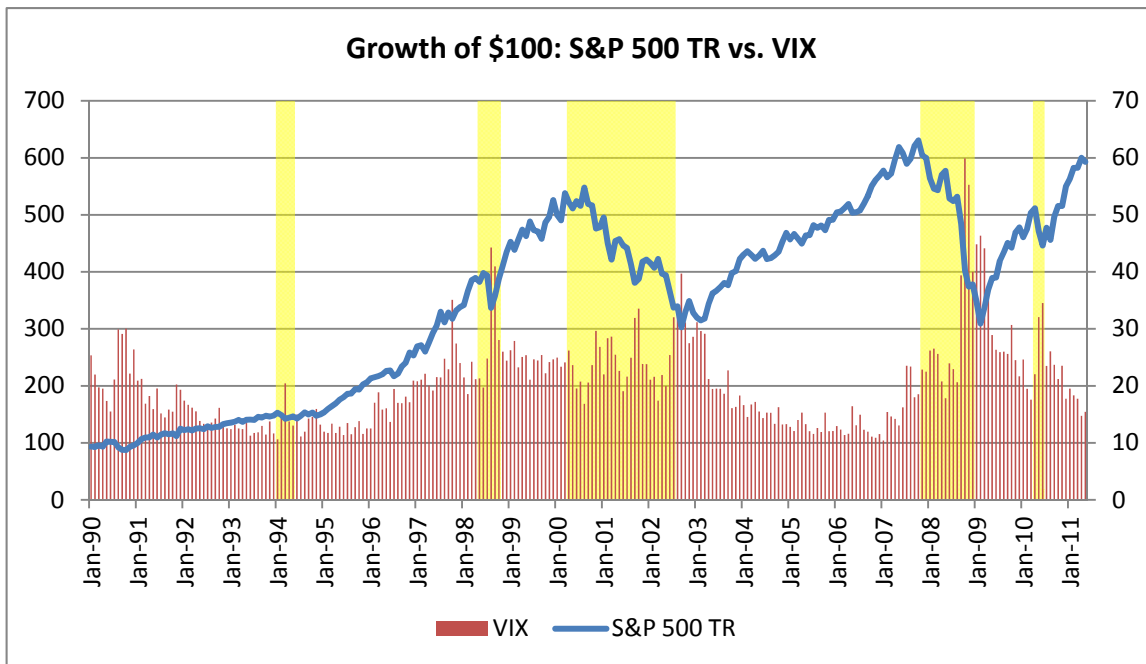
Source: S&P 500 TR from PerTrac, VIX from Yahoo Finance

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[3] In October 1989, when one of us (ED) was working with the mortgage desk at Salomon Bros., there was a mini S&P crash, similar to but not as bad as Oct 1987. Markets were not as well connected electronically in those days, and news took a little longer to travel, even from the equity floor to the fixed income floor within one firm. On the fixed income floor there was a sudden "Oooh" that spread from desk to desk. Traders, watching the fixed income screens on their Quotrons, saw a sudden drop in short-term Treasury yields. It took a little longer before they realized that money was rapidly flowing from equities to the safety of short-term Treasuries.

Like investors in the stock market, hedge fund investors experience fear and panic too, and their crises also tend to correspond to periods in which the VIX is high, as shown in Figure 4. This correlation of crises with increases in volatility makes it worthwhile to examine the exposure of hedge fund strategies to implied volatility.

Figure 4: HFRI Return and the Level of the VIX

Growth of $100: HRFI Fund of Funds Composite vs. VIX
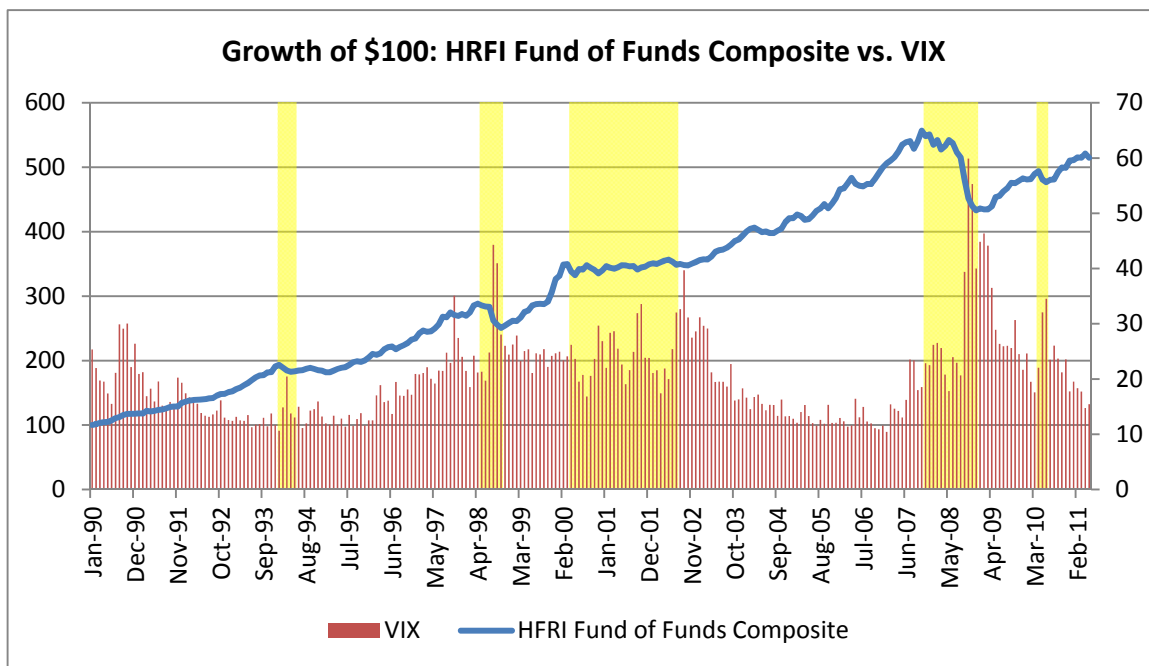
Source: HFRI from PerTrac, VIX from Yahoo Finance

Figure 4 illustrates empirically that hedge funds are usually short volatility. The reason is that most hedge funds rely on a model of market behavior to put on or unwind trades. But models are only models, not the world itself. Models are based on an imaginative view of how markets will move in the future. There are more things in heaven and earth, and so imagination is regularly confounded by market behavior; most if not all models therefore work for only a limited range of imagined scenarios. When the world moves sharply out of those ranges – that is, when volatility kicks in – the model will likely be wrong. This means that, whether they know and acknowledge it or not, most hedge funds are short volatility. Even when they intend to be long volatility, their reliance on models will likely make them be short *the volatility of volatility*. Let's look at some specific examples.

Hedge Fund Research Inc. groups hedge funds into the following four strategy groups: Equity Hedge, Event Driven, Macro and Relative Value.

- **Equity Hedge** consists predominantly of long-short equity funds that try to get their alpha from stock picking. Stock pickers need volatility to differentiate stock returns. In that sense, you would think that long-short funds are naturally long volatility, but that's the case only during "normal," mild volatility regimes. For larger market declines they will be short volatility, because most funds are net long and there is a negative correlation between market levels and volatility. Furthermore, when volatility changes sharply, as it does in a crisis, their model is likely to fail too. During crises, therefore, they will be short volatility.

- **Event Driven** strategies – Mergers and Acquisitions, Risk Arbitrage, and Distressed Investing, for example – are intrinsically short volatility[4]. Risk arbitrageurs typically take positions that assume that the spread between the stocks of companies planning mergers will narrow. During crises, prices are likely to diverge and planned mergers become less likely.

- **Relative Value** strategies, among them Fixed Income, Volatility and Convertible Arbitrage, can in principle adopt long or short volatility exposures. But even long volatility strategies tend to be short volatility on crisis moves, as explained below.

  A convertible fund, for example, has exposure to equity levels, interest rates, credit spreads and equity volatility through the options embedded in convertible bonds. Naively, therefore, the fund is long equity volatility. But when crises, and especially equity market crises begin, equities jump down, credit spreads widen, and the value of the fixed-income component of the convertible is diminished. This negative correlation between equity levels and credit spreads means that even convertible funds are short volatility for large market moves.

  To take a different example, holders of mortgage securities are naturally short a prepayment option to homeowners, struck at low interest rates, and are therefore also short interest rate volatility.

- **Macro** funds are the single class of hedge funds likely to be genuinely long volatility. CTA funds that trade momentum increase their exposure in (what they think are) rising markets and decrease it in (what they think are) falling ones. When markets move sideways with unclear direction, macro funds do less well. Macro funds are therefore synthetically long a straddle, that is, long volatility.

  Very high levels of volatility, however, cause other market participants to behave in irrational or at least unusual ways that thwart the macro manager's paradigm. Like most model-driven funds, macro funds will therefore have a negative exposure to very high volatility.

In summary, hedge funds are usually short volatility in a crisis. Since volatility is one of the few parameters that tends to increase during global crises, protecting a fund of funds is often a question of gaining a substantially long exposure to volatility or to an asset reliably correlated with it.

5. GAUGING PROTECTION

A METRIC FOR PROTECTION

It is easy to obtain protection against market crashes by shorting the market, but protection has a cost. A short position is linear, and the protection against declines comes at the cost of a corresponding loss during market rises. The best kind of protection is put-like rather than simply short, providing protection on the downside but no loss on the upside except for the cost of the premium. (Even better, of course,

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[4] *See Kresimir Demeterfi , Emanuel Derman , Michael Kamal , and Joseph Zou. "A Guide to Volatility and Variance Swaps", The Journal of Derivatives, 6(4) Summer 1999, pp. 9 - 32.*

would be straddle-like protection that generates gains in up and down markets.) What one wants is a short position on the downside combined with as much *convexity* as possible.

For practical reasons, a fund of funds can devote only a limited fraction of its NAV to insurance. In what follows, we will usually assume the fund of funds assigns 5% of its NAV to a security providing protection.[5] In those cases in Section 8 where the fund buys derivatives as protection on a monthly schedule, we assume instead that it spends 0.5% of the NAV monthly.

Consider the returns on $100 invested in a fictional sample fund of funds, with the historical monthly returns arranged in order from most negative to most positive, as shown schematically in Figure 5. Now imagine replacing $5, i.e. 5% of the fund's NAV, with an investment in a strategy that provides hoped-for protection. The resultant returns of this portfolio, 95% fund of funds and 5% protection, are shown by the red line. The difference between the two lines is the protection provided by the insurance, as shown in Figure 6.

The gross shape of the returns illustrated in Figure 6 is convex, providing protection and increased return when the fund of funds' returns are significantly negative, and resulting in no significantly increased losses for positive fund of funds returns.

Figure 5: The graph below (and in Figures 6-8 on the following pages) is included to illustrate the methodology used on the following pages. This schematic shows ordered monthly returns of a model sample fund of funds over some sample time period, arranged from lowest to highest, and the corresponding returns for the same fund of funds with 5% of the NAV devoted to "protection". These curves are entirely illustrative and not based on actual data or any particular protection strategy. The black curve representing the returns of the fund of funds is monotonically increasing by construction.
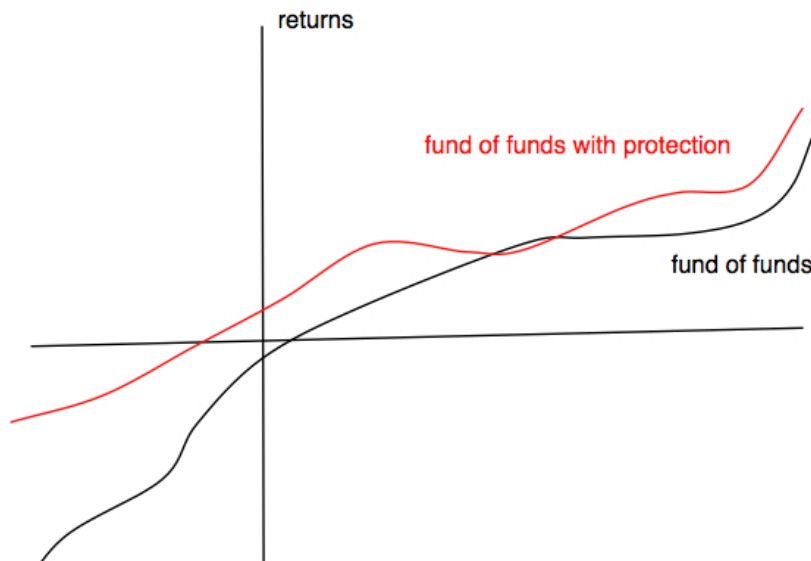
Source: Prisma Capital Partners

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[5] *This fraction is arbitrary but, we believe, reasonable. As we shall see, most protection is expensive and produces little benefit other than the protection. It is therefore unlikely any fund would spend much more than 10% on protection, since it would be preferable to go into cash rather than spend so great an amount on risk insurance.*

Figure 6: Schematic monthly excess returns of a model fund of funds as a result of devoting 5% of the fund's NAV to protection. This curve is illustrative and not based on actual data or any particular protection strategy.
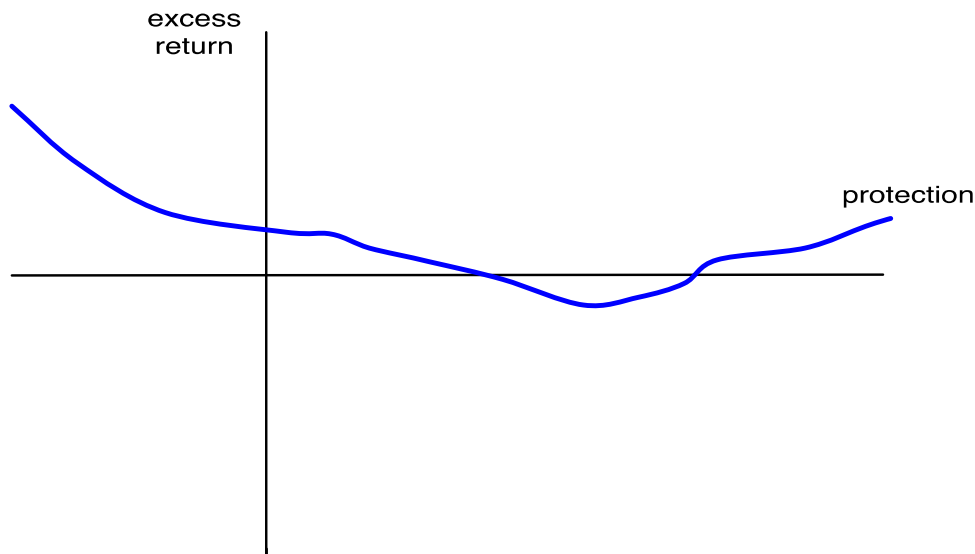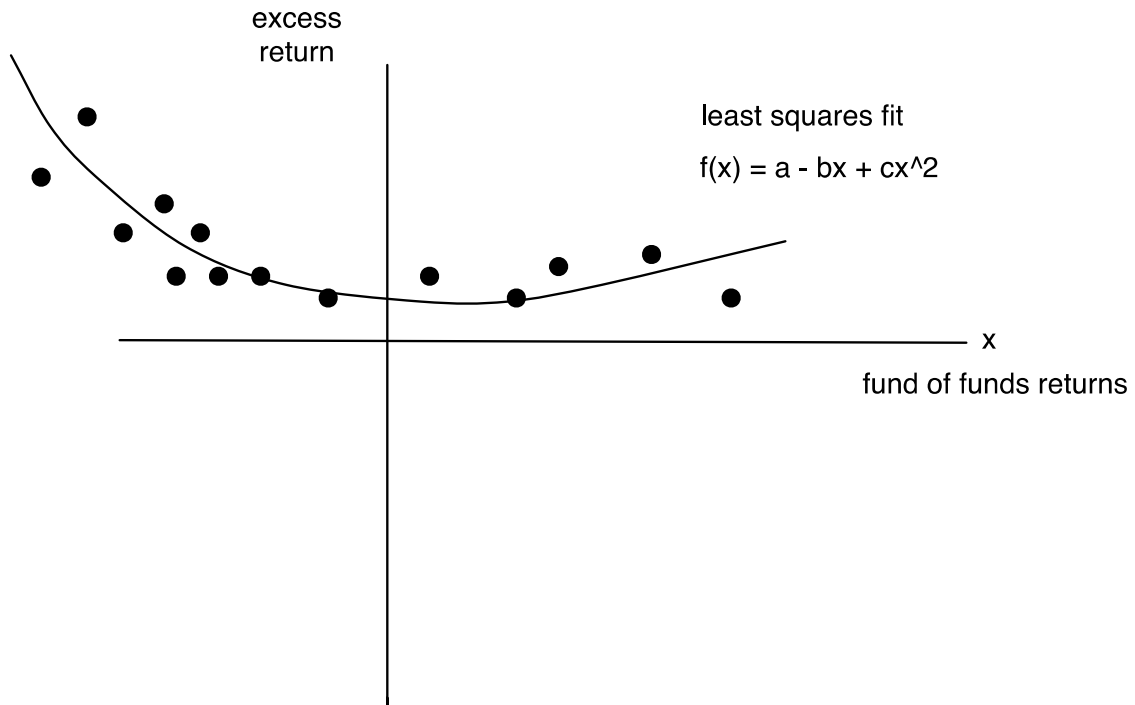

Source: Prisma Capital Partners LP

Figure 7 displays a still schematic but more realistic graph of excess returns, illustrating individual monthly points and the best least-squares quadratic fit to them. We parameterize the fitted quadratic function by the formula $f(x) = a - \beta_{HFRI}x + \gamma_{HFRI}x^2$. The *convexity* of returns is determined by the coefficient γ_{HFRI}, whose value measures their option-like behavior. The degree of insurance against negative returns is measures by the slope β_{HFRI}, which we refer to as the *HFRI beta* of the protection strategy. The larger (and more positive) β_{HFRI} and γ_{HFRI}, the better the protection.

In practice, one cares little about the values of β_{HFRI} and γ_{HFRI} when the fund of funds' returns x are close to zero; it is the large negative returns that concern us, and therefore we will focus on the slope β_{HFRI} for large negative returns, which we arbitrarily choose to define by negative returns exceeding 2% in magnitude, as illustrated in Figure 8. We will evaluate a variety of possible protection strategies in terms of the slope β_{HFRI} they provide in this region, as well as their convexity.

Figure 7: Excess monthly returns for a model fund of funds provided by a protection strategy, and the quadratic least squares fit to it.

Source: Prisma Capital Partners LP

Figure 8: Excess monthly returns for a model fund of funds provided by protection strategy, fitted piecewise. The slope relevant for protection during crises is β_{HFRI}, the slope for HFRI fund of funds returns less than −2%.
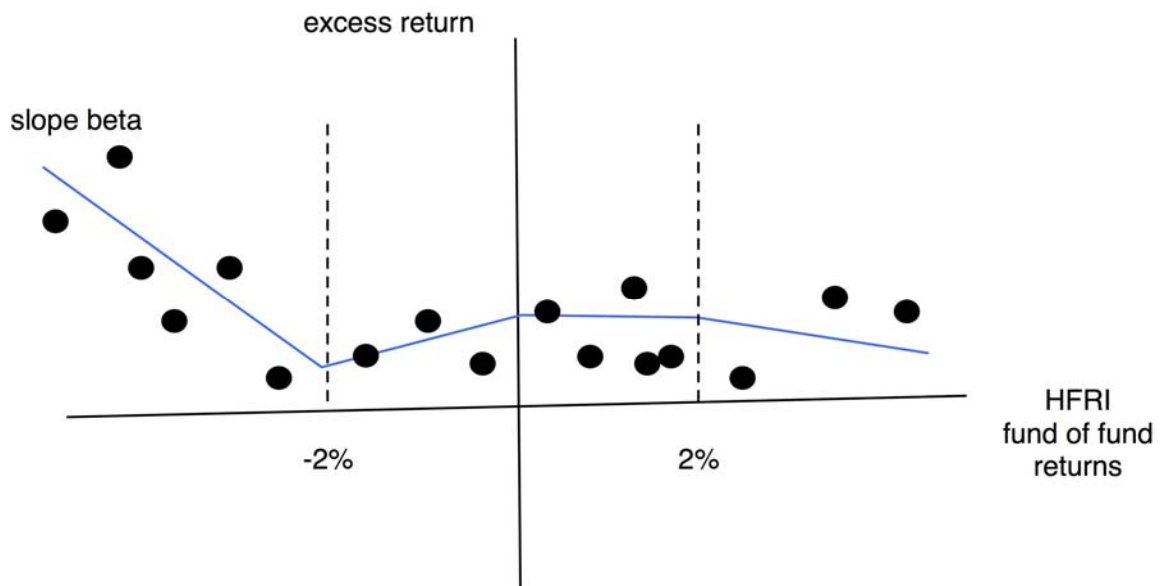
Source: Prisma Capital Partners LP

We define the following metrics to quantify the protection provided by a strategy:

1. The *benefit* is the average number of excess basis points of monthly protection provided when the HFRI has negative monthly returns.

2. The *penalty* is the average number of basis points of monthly return given up when the HFRI has positive monthly returns.

3. The *cost* is the average number of basis points of monthly return given up over all (positive and negative) HFRI monthly returns. Because the numbers of positive and negative returns are not generally equal, the cost is not necessarily equal to the penalty less the benefit.

TYPES OF PROTECTION

We consider two classes of insurance. The first is to invest in a hedge fund that provides tail protection, a strategy consistent with the general charter of a fund of funds. The second is to use an overlay – an investment in one or more non-hedge-fund securities, underliers or derivatives – that provides protection against specific disaster scenarios. We will examine the protection provided by both such classes in the remainder of this report

6. HEDGE FUNDS FOR TAIL PROTECTION

Figure 9 displays the ordered monthly returns of the HFRI Composite Index, arranged on the horizontal axis from low to high. We will use these returns as our fund of funds benchmark.

Figure 9: The ordered monthly returns of the HFRI Fund of Funds Composite Index from Jan 1990 – May 2011.
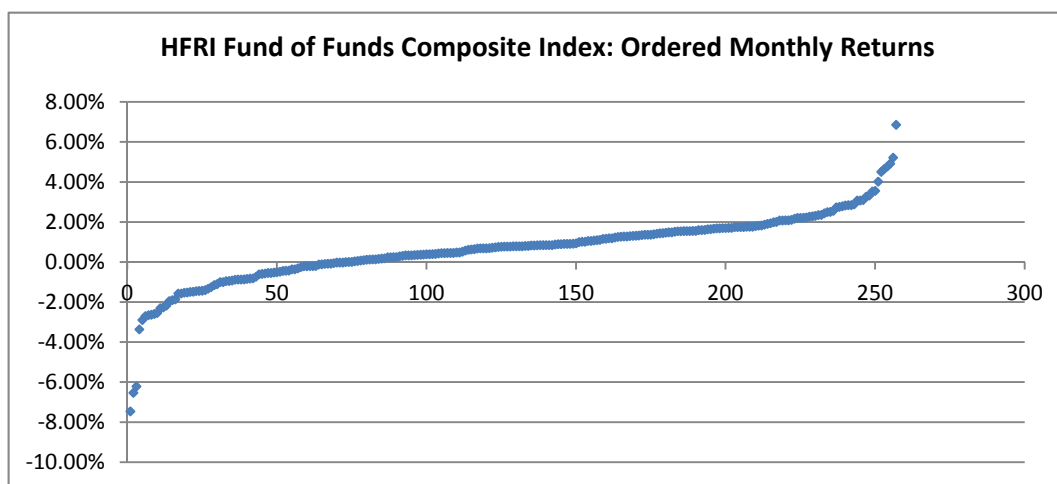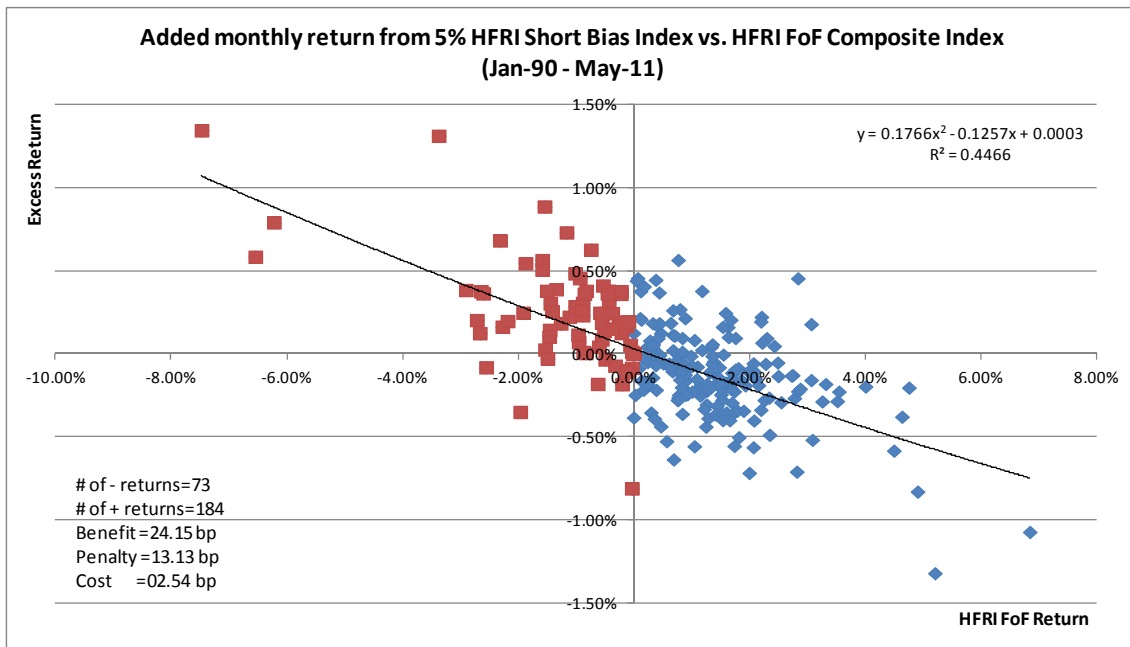

Source: PerTrac

SHORT BIAS FUNDS

The simplest protection is afforded by using hedge funds that short the equity market. Figure 10 displays the corresponding excess returns obtained by including a 5% allocation to the HFRI Short Bias Index together with a 95% allocation to the HFRI Composite Index of Figure 9.

Notice that the Short Bias Index generates a β_{HFRI} of 13% and almost zero convexity, with a high R-squared of 45%. It's pretty much equivalent to a pure short position on the HFRI. With a β_{HFRI} of 13%, a 5% investment in the Short Bias Index has statistically provided a hedge for only about 1/8 of the 95% investment in the HFRI Composite Index. It would require an impractically large allocation of 40% to the Short Bias Index to obtain a β_{HFRI} that protects the entire portfolio.
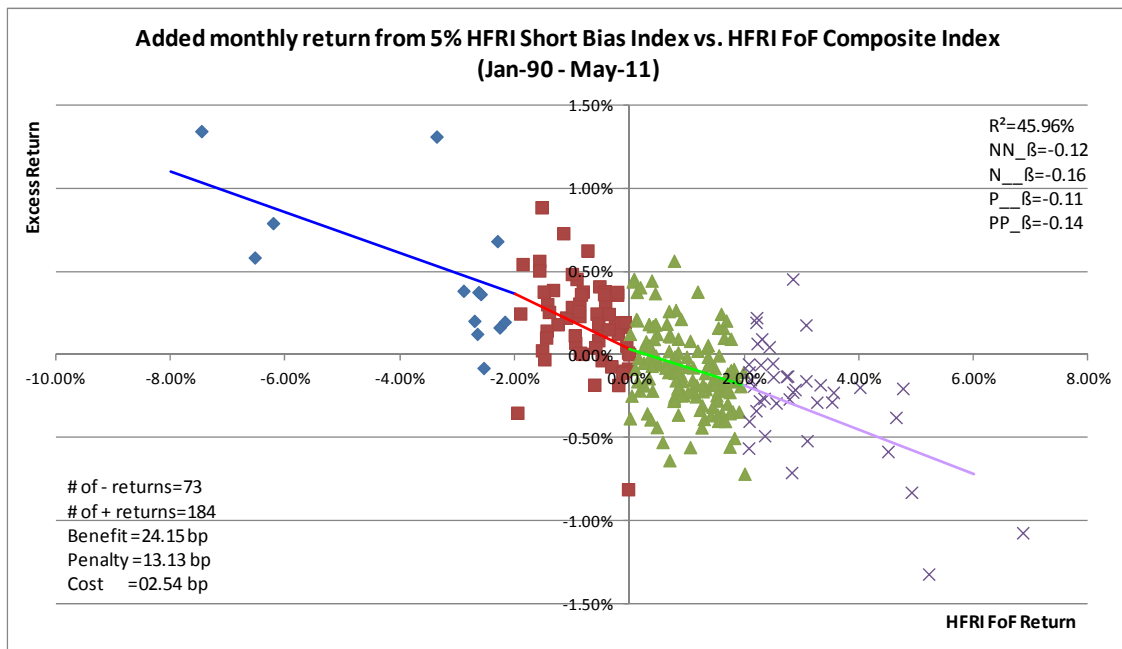
Figure 11 shows the same data fitted piecewise linearly with breaks at HFRI returns of –2% and 2%. The protection for monthly tail returns below -2% has a β_{HFRI} of 12%. Though the historical cost of the protection has been only about 2.54 bp per month, the protection provided by a 5% allocation has been insufficient during crises.

Figure 10: Excess return provided by a 5% allocation to HFRI Short Bias Index. The red squares (blue diamonds) correspond to negative (positive) HFRI FoF Composite returns. The solid line is a least-squares best fit.

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac

Figure 11: Excess return provided by a 5% allocation to HFRI Short Bias Index, fitted piecewise. Here, and in all subsequent graphs, the blue diamonds denote HFRI Fof Composite returns lower than -2%; the red squares correspond to returns between -2% and 0%; the green triangles to returns between 0% and 2%; and the grey X's to returns greater than 2%. The solid line is a piecewise continuous least-squares best fit.

Added monthly return from 5% HFRI Short Bias Index vs. HFRI FoF Composite Index (Jan-90 - May-11)

R^2=45.96%
NN_ß=-0.12
N__ß=-0.16
P__ß=-0.11
PP_ß=-0.14

# of - returns=73
# of + returns=184
Benefit =24.15 bp
Penalty =13.13 bp
Cost   =02.54 bp

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac

CTA FUNDS

The Barclays BTOP 50 Index of managed futures funds can serve as a proxy for an investment in CTA-style hedge funds. As is evident from Figure 12, a constant 5% allocation to the BTOP 50 (in addition to a 95% allocation to the HFRI FOF Composite Index) has provided a β_{HFRI} of 8% with an R-squared of 25%, even less protection than that provided by the Short Bias Index, but with greater and more straddle-like convexity. This convexity is just what we expect, ideally, from a liquid successful trend-following fund. The net cost of the BTOP has been close to zero bp per month.

Figure 12: Excess return provided by a 5% allocation to BTOP 50 Index. (a) Solid line is fitted piecewise. (b) Fitted quadratically.
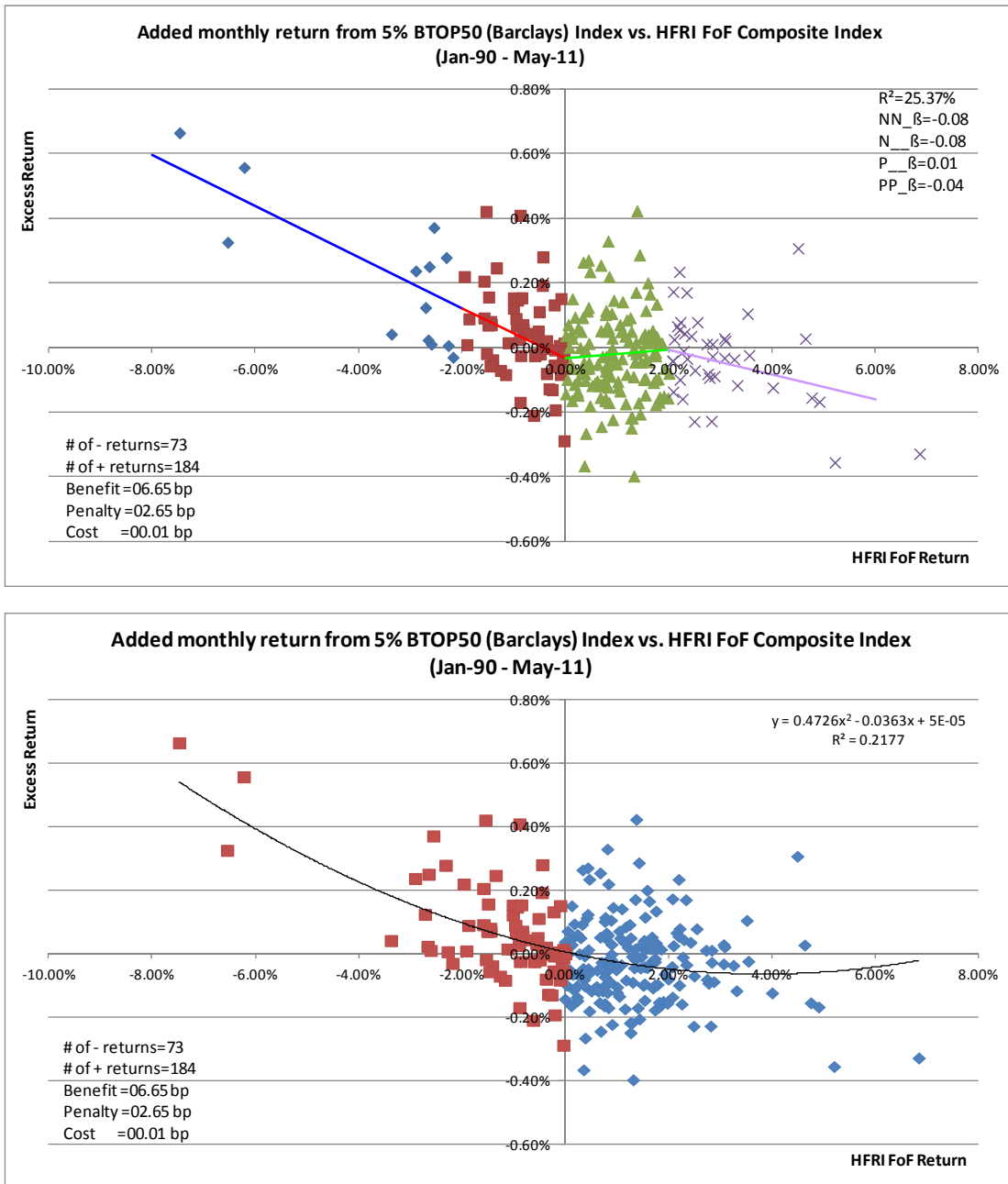
Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from Barclayhedge.com regarding the BTOP50 and from PerTrac regarding the HFRI.

Figure 13 displays a comparable convexity from a 5% investment in the HFRI Macro Index, a similar proxy for CTA funds.

Figure 13: Excess return provided by a 5% allocation to HFRI Macro Index
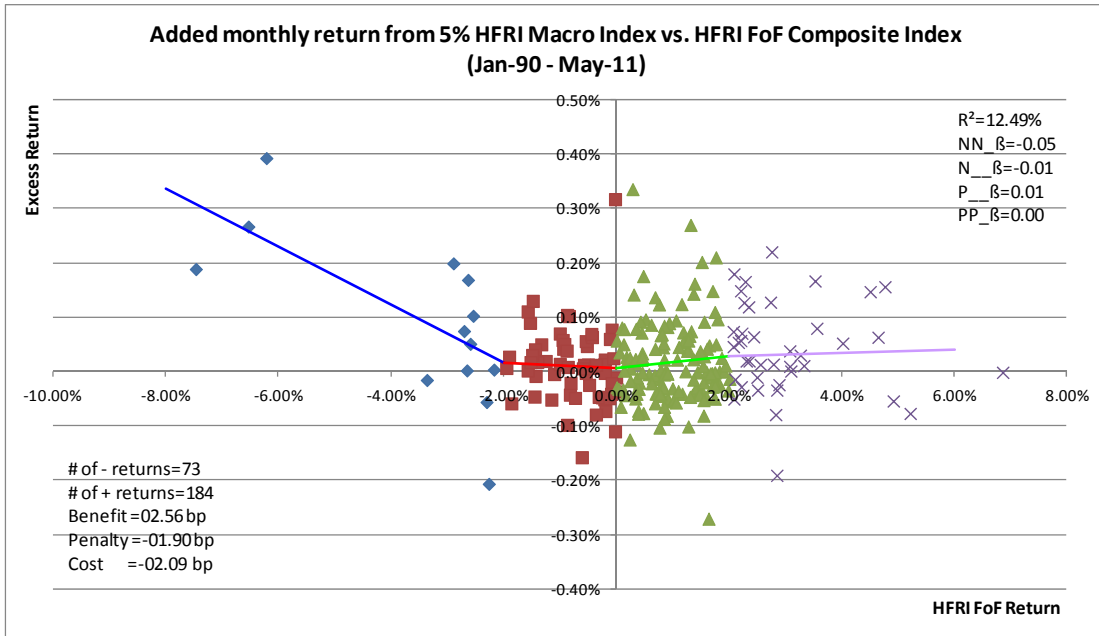
Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac

EQUITY MARKET NEUTRAL FUNDS

Equity Market Neutral funds aim to provide a very low β_{HFRI} while also generating straddle-like protection with negligible cost. Figure 14 demonstrates that the HFRI Equity Market Neutral Index really has been close to market-neutral, generating a small amount of protection on the downside and a similarly small amount of loss on the upside, with a high R-squared. Unfortunately, the downside β_{HFRI} of 3% is much too small.

CONCLUSION

CTA funds can provide both β_{HFRI} and convexity. At the 5% level they provide too little protection, but with an investment of about 20% NAV they can yield a substantial hedge against crises, provided they are sustained momentum-driven crises. They are unlikely to be much use in a sharp immediate market decline that reflects a sudden change in perceptions rather than a prolonged momentum-friendly trend.

Figure 14: Excess return provided by a 5% allocation to HFRI Equity Market Neutral Index
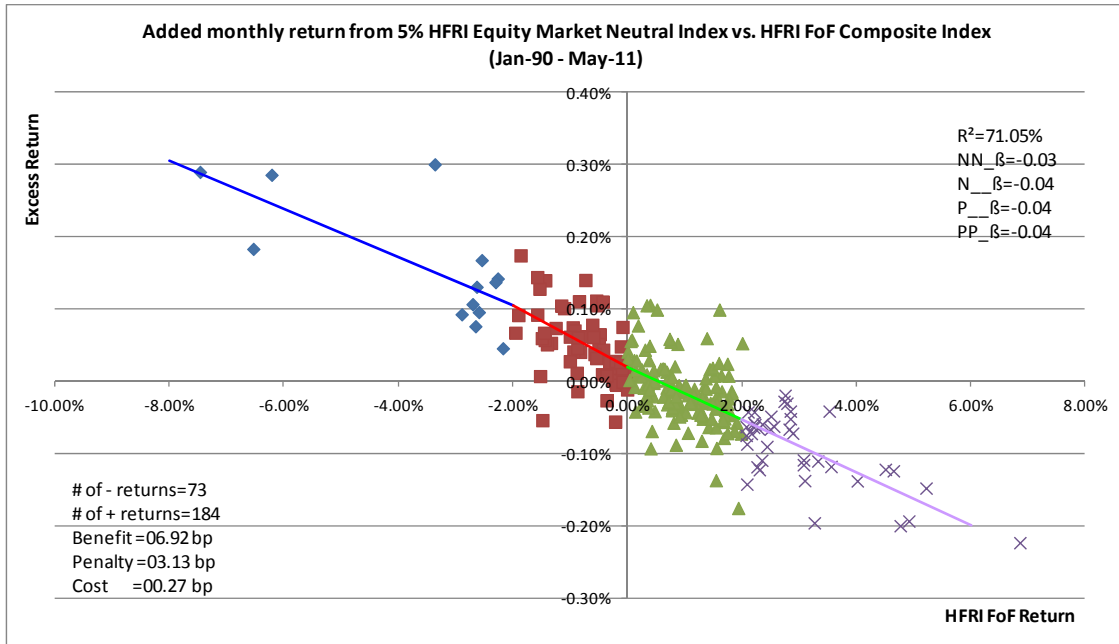
Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac

7. COMMODITY OVERLAYS FOR TAIL PROTECTION

In this section we analyze overlays that utilize securities other than hedge funds for tail protection. A major advantage of overlays is that they are relatively liquid and can be traded rapidly in large quantity.

PHYSICAL GOLD

A natural protection candidate is gold, whose performance since the onset of the recent financial crisis has reputedly been a useful hedge against the increasing fear of excesses of fiat money, inflation, and political, economic and financial decline. Figure 15 displays the excess return provided by a 5% allocation to physical gold since 2005. It has provided straddle-like behavior with a net (negative, i.e. advantageous) cost of -8 bp per month, but with a disappointingly negative β_{HFRI} of about –3% and a low R-squared. The low value of β_{HFRI} is partly a reflection of the post-2008 market recovery that has nevertheless been correlated with a rise in the price of gold. The downside protection β_{HFRI} would be positive and larger (about 11%) if not for one outlying negative return of -0.6% corresponding to a 6% downward move in the HFRI Composite Index in October 2008.

Figure 15: Excess return provided by a 5% allocation to physical Gold since Jan 2005
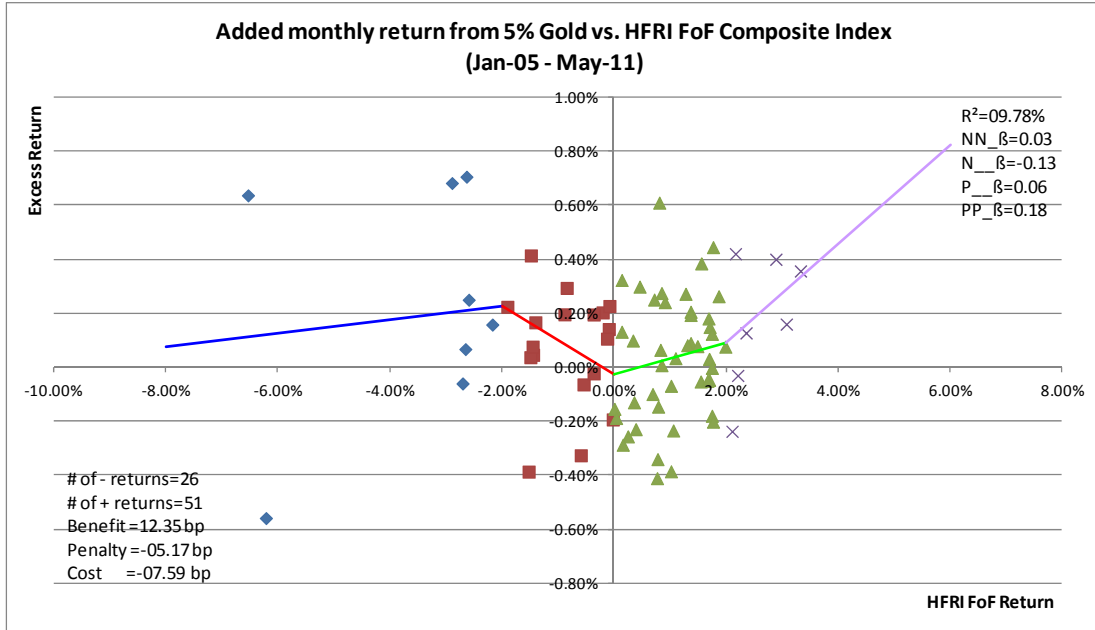
Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from kitco.com regarding gold.

Over the longer time period since 1990, Figure 16 shows that gold has not provided much better protection. Though it is a useful part of a diversified portfolio, gold has not clearly provided responsive protection in downside crashes; its price seems to respond more slowly to increasing fears of inflation rather than sudden crises.

Figure 16: Excess return provided by a 5% allocation to physical Gold since Jan 1990

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from kitco.com regarding gold.

OIL

Since January 2007 WTI oil has been positively correlated with the market, so that a 5% *short* position in oil has generated a relatively large β_{HFRI} of 19% with an R-squared of 73%, as shown in Figure 17.
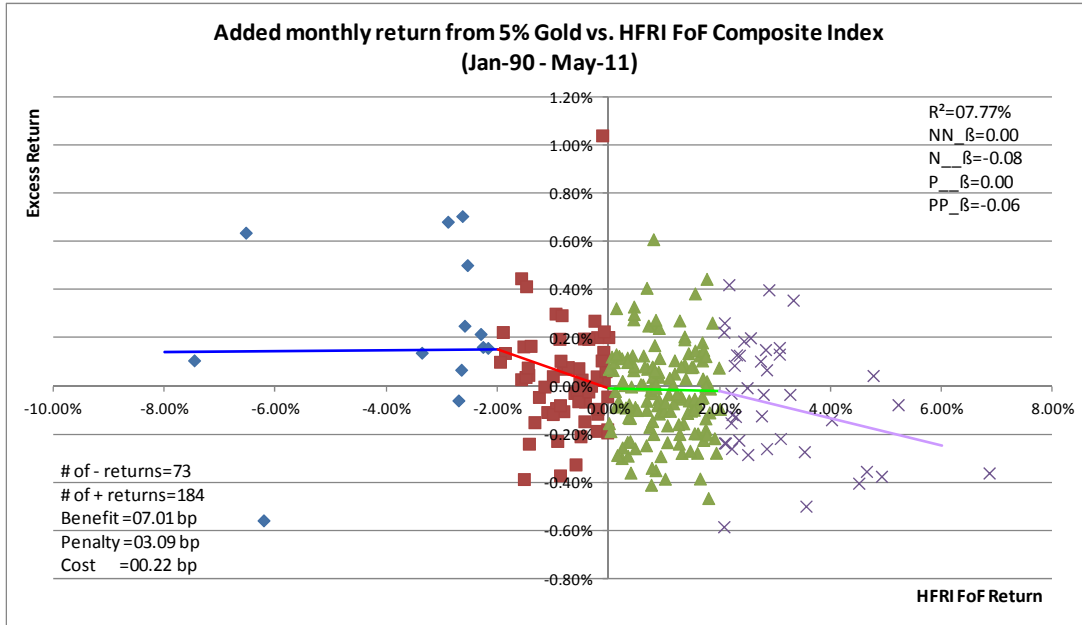
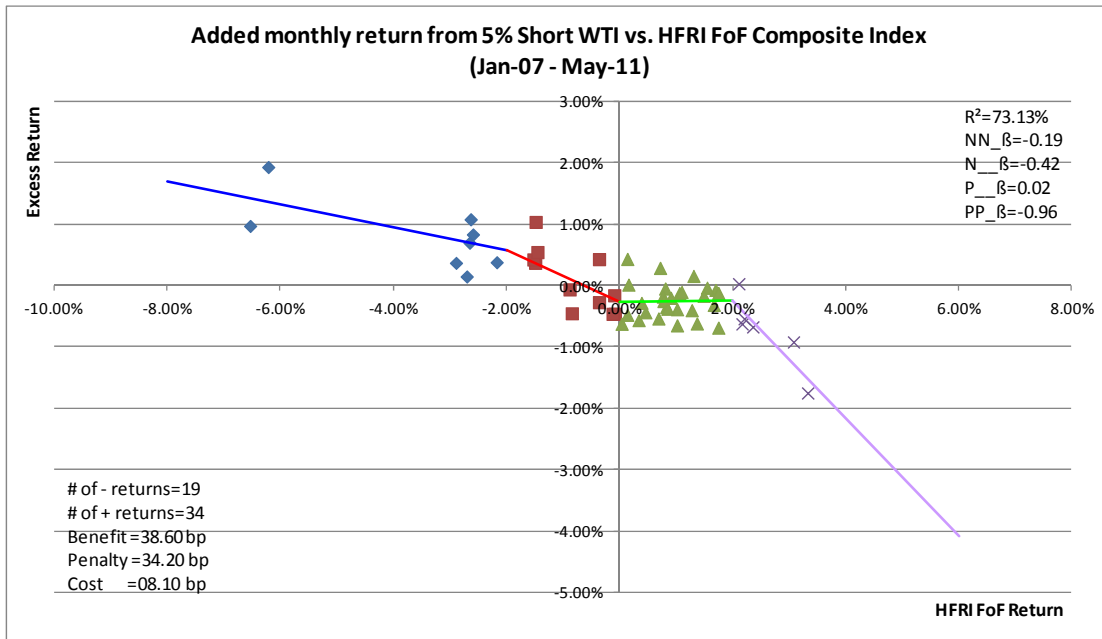**Figure 17:** Excess return provided by a 5% allocation to WTI Oil since Jan 2007

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from eia.gov (Energy Information Administration) regarding WTI

But since 1990, as shown in Figure 18, though the β_{HFRI} has still been 19%, the R-squared has declined to 19%. Oil prices have suffered through a variety of regimes, some correlated with markets and some anti-correlated, making it an unreliable provider of protection. Politics plays too large a part in its pricing. The same has been generally true of most commodities.

Figure 18: Excess return provided by a 5% allocation to WTI Oil since Jan 1990.
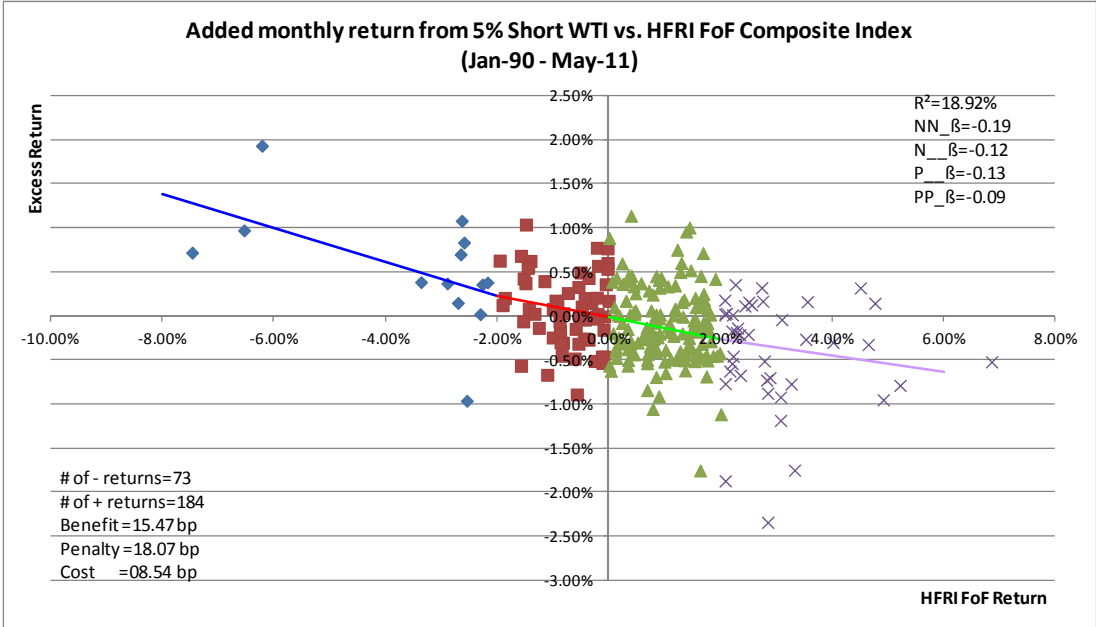
Added monthly return from 5% Short WTI vs. HFRI FoF Composite Index (Jan-90 - May-11)

R²=18.92%
NN_ß=-0.19
N__ß=-0.12
P__ß=-0.13
PP_ß=-0.09

\# of - returns=73
\# of + returns=184
Benefit=15.47 bp
Penalty=18.07 bp
Cost =08.54 bp

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from eia.gov (Energy Information Administration) regarding WTI

8. OVERLAYS USING CREDIT DEFAULT SWAPS

Fear of default characterized the financial crises of 1998 and 2008. Since the advent of credit default swaps, it has become easier to hedge specifically against default.

Figure 19: Excess return provided by a 5% allocation to the Barclays Europe Short-Credit 5 Year Main Index

Added monthly return from 5% Barclays Europe Short-Credit 5 Year Main Index vs. HFRI FoF Composite Index
(Jul-04 - May-11)

R²=92.17%
NN_ß=-0.06
N__ß=-0.06
P__ß=-0.06
PP_ß=-0.05

of - returns=28
of + returns=55
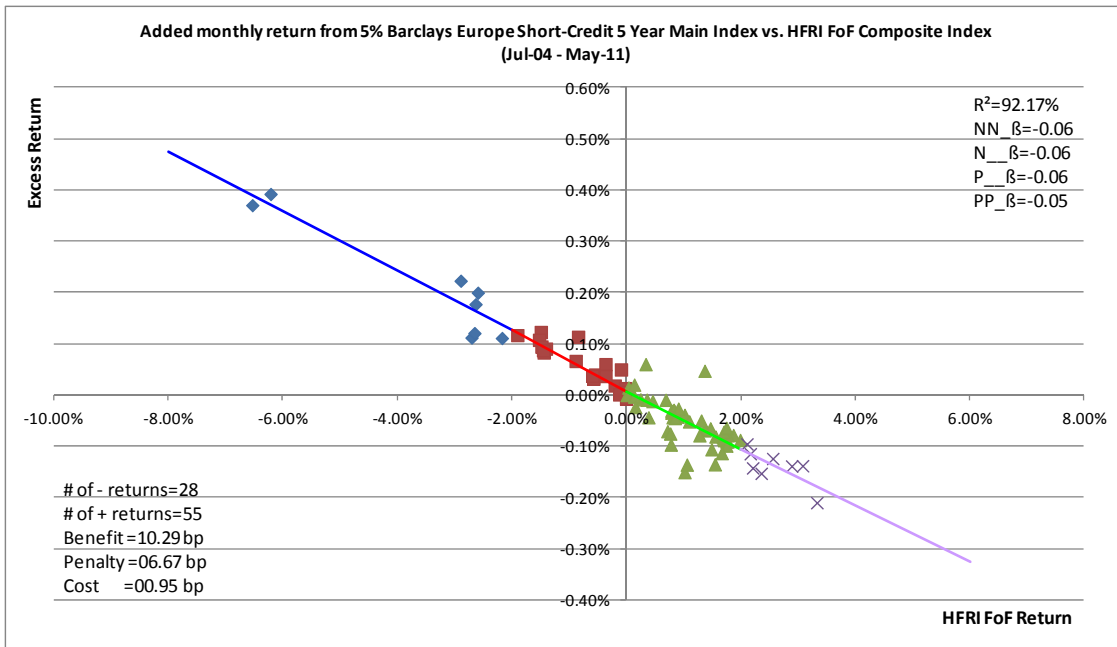Benefit =10.29 bp
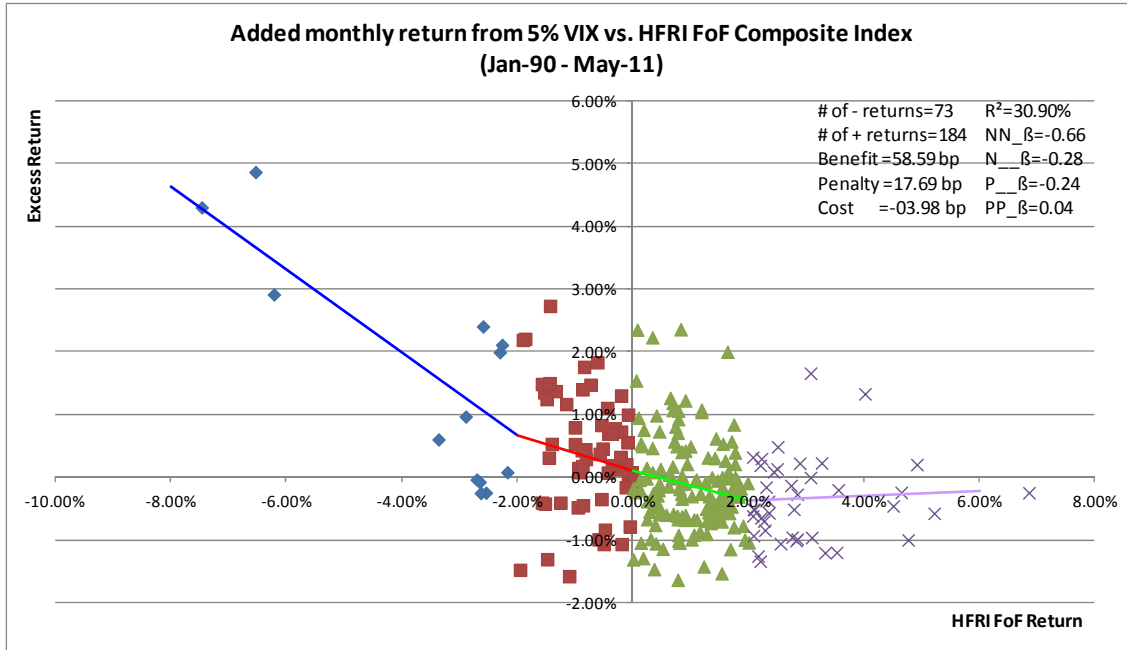Penalty =06.67 bp
Cost   =00.95 bp

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from ecommerce.barcap.com regarding BESC.

Figure 19 displays the protection provided by a 5% position in the Barclays Europe Short-Credit 5 Year Main Index, which tracks the performance of a short-credit position in the credit derivatives market, using the iTraxx® on-the-run series as the underlying index. Because the crisis that began in 2008 was a credit crisis, and because of the exposure of hedge funds to credit spreads, the protection provided by CDS since then has been almost entirely equivalent to a short position in the HFRI Composite Index with an R-squared of 92% with β_{HFRI} = 0.06 and low convexity. The same is the case for a 5% allocation the Barclays North America Short-Credit 5 Year Main Index. Being short credit is a good tactical hedge in a credit crisis, but not in general.

9. VOLATILITY OVERLAYS

We have remarked that the almost universal characteristic of crises is an increase in equity volatility. To see this, pretend for a moment that you can directly buy and sell the VIX – you cannot of course, since the VIX is an index rather than a tradable security and isn't tradable – and then combine an imaginary 5% position in the VIX with the HFRI Composite Index. Figure 20 illustrates the protection provided by this imaginary strategy.

Figure 20: Excess return provided by a 5% allocation to an imaginary VIX-like security since Jan 1990

Added monthly return from 5% VIX vs. HFRI FoF Composite Index
(Jan-90 - May-11)

# of - returns=73   R²=30.90%
# of + returns=184   NN_ß=-0.66
Benefit=58.59 bp   N__ß=-0.28
Penalty=17.69 bp   P__ß=-0.24
Cost   =-03.98 bp   PP_ß=0.04

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from Yahoo Finance regarding VIX.

With a β_{HFRI} of 66%, an overall R-squared of 31% that is even greater in the tail alone, as well as a negligible cost, this hypothetical VIX-like security would be an outstanding hedge against most kinds of tail risk. Since it doesn't exist, however, we are forced to examine derivatives of the VIX that are tradable.

Figure 21 displays the protection provided by rolling VIX futures via a 5% allocation to the S&P 500 VIX Mid-Term Futures Index (Bloomberg ticker SPVXMTR) that measures the return from the daily rolling of a long position in the fourth, fifth, sixth and seventh month VIX futures contracts. The SPVXMTR is not directly tradable either, but is an index whose calculated value is based on a tradable strategy. With a profile similar to that of Figure 19, the strategy provides a high R-squared hedge for a fund of funds, providing a historical β_{HFRI} of about 30%.

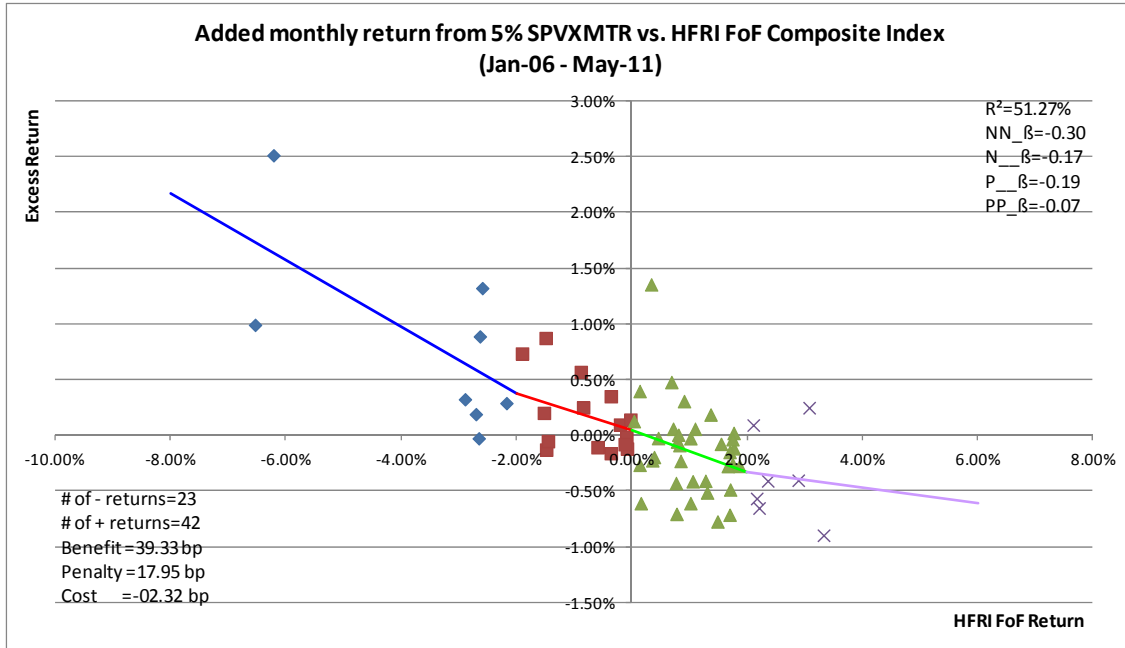**Figure 21:** Excess return provided by a 5% allocation to the SPVXMTR

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from Bloomberg regarding SPVXMTR

Unfortunately, the SPVXMTR index has been in existence only since 2006, because its calculated value relies on market data from the relatively recent introduction of VIX futures contracts. Markets since 2006 have been turbulent and therefore eminently amenable to volatility hedging, and so these results may be overly optimistic in the long run.

What would have happened in less crisis-ridden times? To examine this, we look at put-buying strategies for protection, for which a longer history is not difficult to obtain.

Monthly Put Purchases

Figure 22 displays the fund of funds protection provided from 1996 to the present by spending 0.5% per month at the start of the month on short-term "at-the-money" ("ATM") puts on the S&P 500 that are then held for one month[6]. We have chosen 0.5% per month to approximate an allocation of 5% per year to protection.

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[6] More specifically, we purchase on the 1st of the month an ATM option expiring in the following month and sell it on the last day of the current month. By ATM we mean the strike closest to but always lower than the S&P 500 closing value.

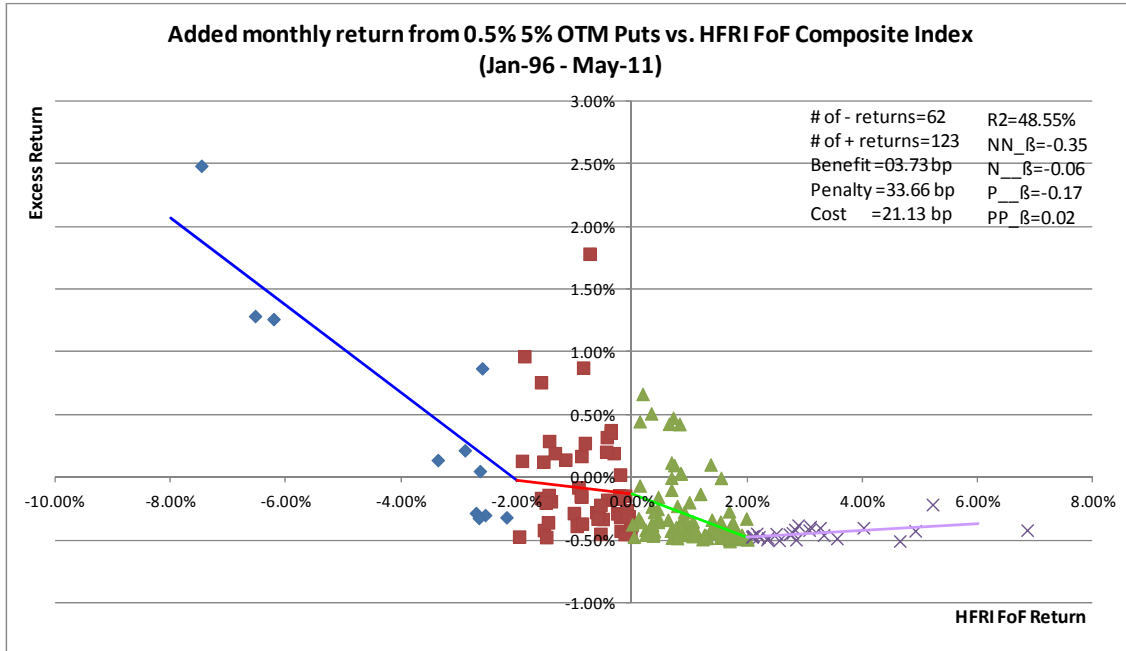**Figure 22:** Excess return provided by a 0.5% monthly allocation to ATM S&P 500 Puts held for one month
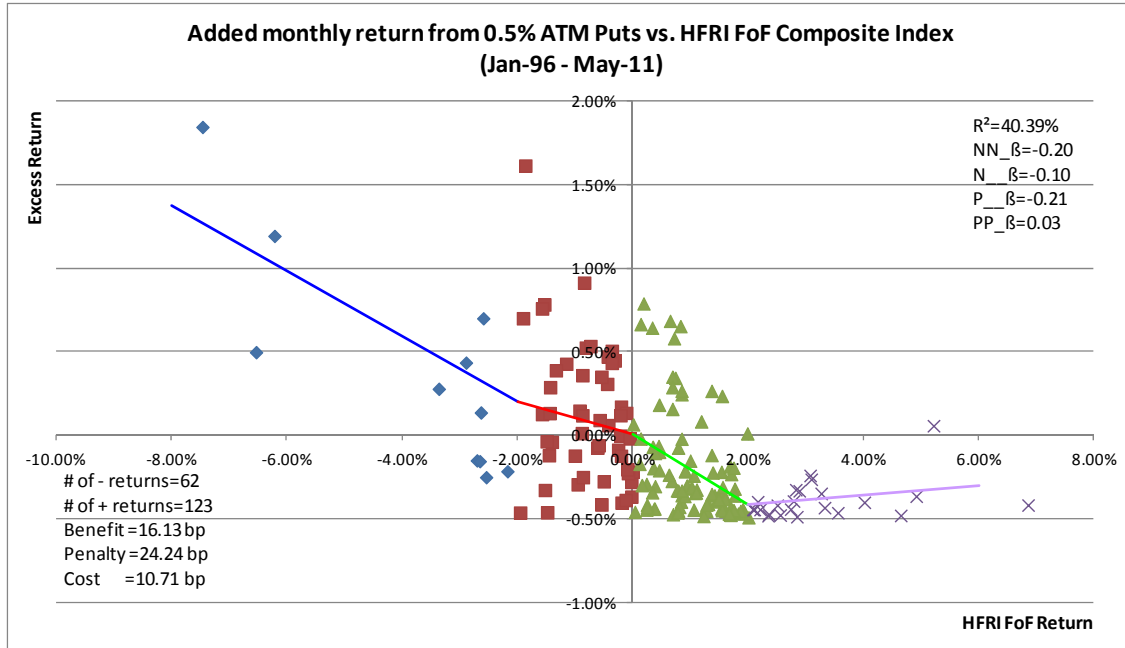
Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from OptionMetrics regarding Put options

The cost of the strategy over the long haul has been 11 bp per month, and the β_{HFRI}, at 20%, is smaller than for the imaginary VIX. It would have taken a five times greater, that is, a 2.5% monthly allocation to these puts to hedge the full value of the HFRI, at a corresponding cost of 55 bp per month. Over the long haul, the losses when the HFRI index rises and the S&P puts expire out of the money, outweigh the protection. Clearly, to carry out a put-buying strategy effectively requires timing.

Figures 23 and 24 illustrate the analogous results where 0.5% of the NAV has been spent on S&P puts respectively struck at 5% and 20% out of the money[7]. Though there β_{HFRI} is substantial (35% and 45% respectively), the long-term costs (respectively 21 and 37 bp per month, compared with 11 bp for an ATM option) get progressively greater as the put strikes move more out of the money. Though out of the money puts are cheaper, they pay off less often, and the net effect is to increase the cost of protection, which is reflected in the predominantly negative excess returns on the right hand side of the Figure 22, where the HFRI returns are positive. A cost of 37 bp per month for 20% out-of-the-money ("OTM") crash-protection puts adds up to a drag on returns of 4.5 percentage points per year, clearly intolerable.
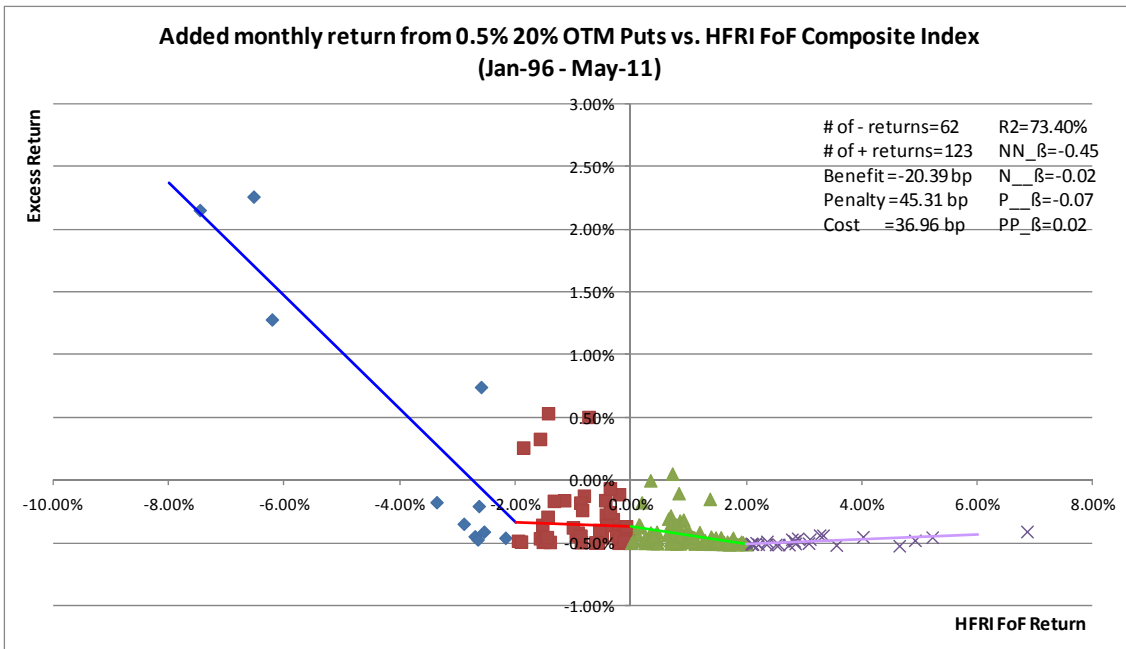
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[7] Puts have discrete strikes and so a strike of exactly 20% OTM is not necessarily available in the market. Therefore we take "20% OTM" to mean, technically, the available put with strike greater than or equal to 20% out of the money that is closest to 20% out of the money.

Figure 23: Excess return provided by a 0.5% monthly allocation to 5% out-of-the-money S&P 500 Puts held for one month

Added monthly return from 0.5% 5% OTM Puts vs. HFRI FoF Composite Index (Jan-96 - May-11)

# of - returns=62   R2=48.55%
# of + returns=123   NN_ß=-0.35
Benefit =03.73 bp   N__ß=-0.06
Penalty =33.66 bp   P__ß=-0.17
Cost   =21.13 bp   PP_ß=0.02

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from OptionMetrics regarding Put options

Figure 24: Excess return provided by a 0.5% monthly allocation to 20% out-of-the-money S&P 500 Puts held for one month

Added monthly return from 0.5% 20% OTM Puts vs. HFRI FoF Composite Index (Jan-96 - May-11)

# of - returns=62   R2=73.40%
# of + returns=123   NN_ß=-0.45
Benefit =-20.39 bp   N__ß=-0.02
Penalty =45.31 bp   P__ß=-0.07
Cost   =36.96 bp   PP_ß=0.02

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from OptionMetrics regarding Put options

In an attempt to reduce the cost, we have tried a strategy that involves *selling* ATM S&P 500 straddles worth 0.5% of the NAV monthly, hoping thereby to partially fund 1% of the NAV spent monthly on protective 20% OTM S&P 500 puts. Figure 25 shows that while the downside β_{HFRI} increases to 82% with a high R-squared of 72%, this protection comes at the cost of greater losses when protection is not needed, producing an historical cost of 69 bp per month.

Figure 25: Excess return provided by a 1% monthly allocation to 20% out-of-the-money S&P 500 Puts held for one month, funded by the sale of 0.5% ATM Straddles

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from OptionMetrics regarding Put options
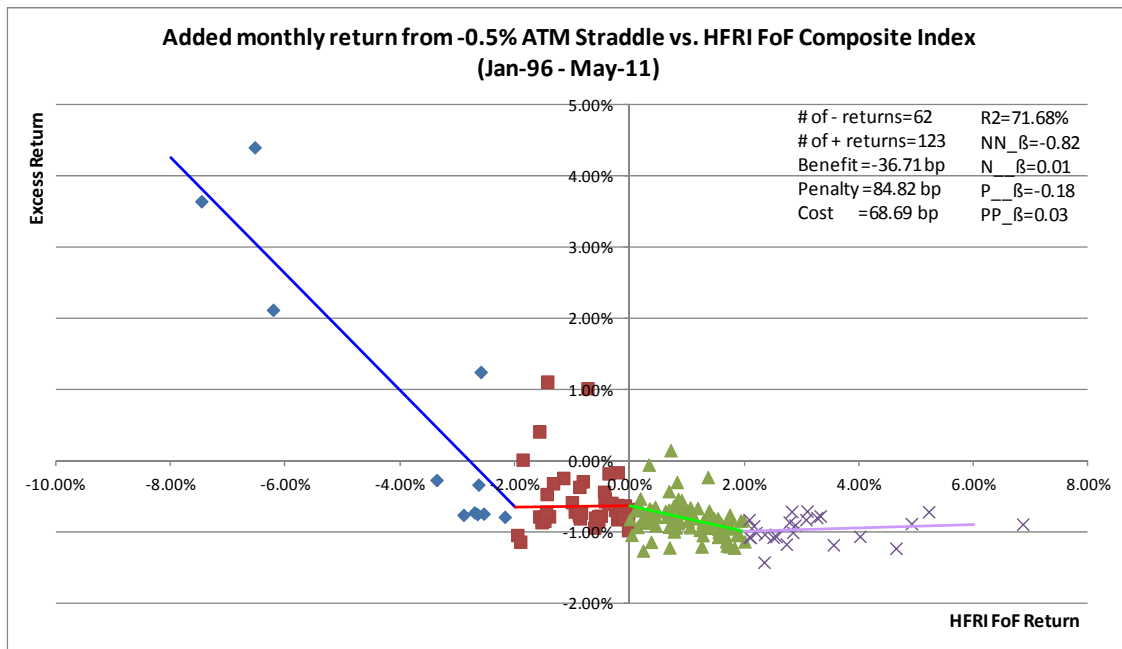
TIMED PUT PURCHASES TRIGGERED BY THE PREVIOUS VIX LEVEL

Since put buying provides the right *scale* of protection but at too large a *cost*, we next investigate whether one can reduce the cost by buying puts only when necessary. There is certainly no easy or reliable way to predict future market collapses with good statistical accuracy, but here we investigate using the level of the VIX, a reflection of options prices, to indicate the possibility of impending trouble.

Figure 26 displays histograms of the monthly returns on the S&P 500 since January 1996, grouped by daily VIX quartiles; each histogram contains returns of the S&P 500 corresponding to the monthly average of the VIX, *one or two months earlier*, having been in a particular quartile. The idea is to see whether the VIX can forecast large downward moves in the S&P.

Figure 26: Monthly returns of the S&P 500 from Jan 1996 – May 2011 corresponding to the daily VIX quartiles one or two months earlier
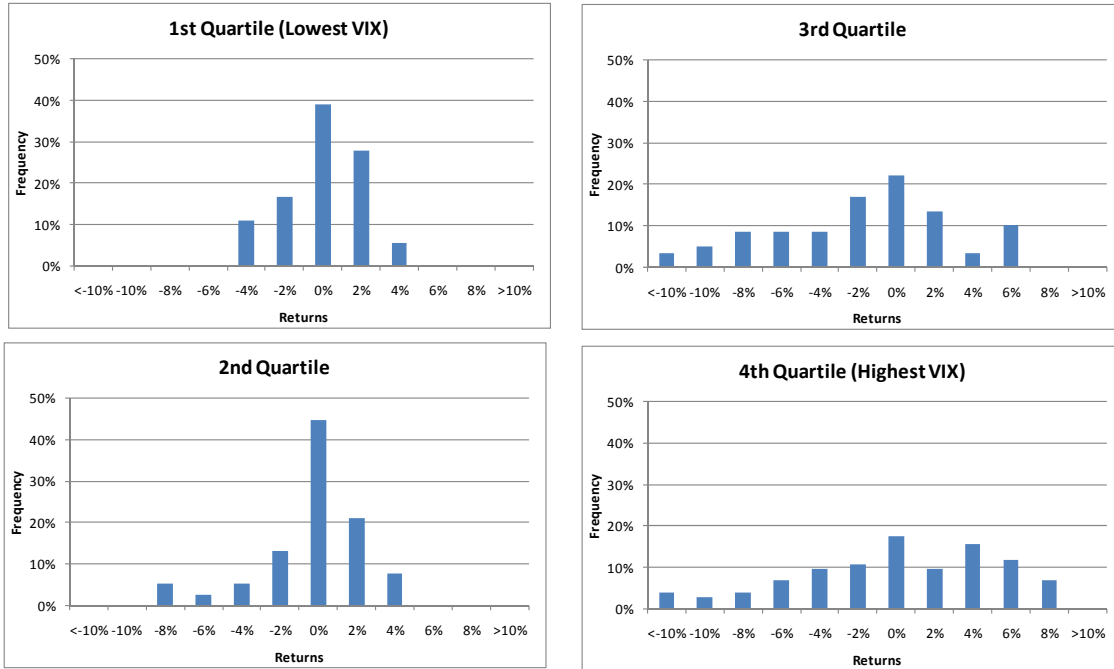

Source: Yahoo Finance

[8]We notice that S&P returns corresponding to the VIX having been in the 3rd quartile from the bottom (the second highest quartile of VIX levels) have the longest tail of negative returns. This suggests that 3rd quartile VIX levels might indicate a sharp downward move in the S&P one or two months later. The "story" behind this, if there is a plausible one, is that when the volatility of the S&P is high (roughly in the range 20%-25%) but not enormous is when protection is statistically most useful. At lower levels of the VIX, disaster is too far away, and at higher levels disaster has arrived and protection is too expensive. Note that in calculating quartiles for the VIX, we continually update the quartiles as we move forward in time.

Given this possible insight, we now investigate the strategy of buying at-the-money S&P puts *only* when the monthly average of the VIX has been in the third quartile either one or two months earlier. Figure 27 displays the excess return from spending 2.5% per month of the HFRI NAV on puts, but only subject to this trigger. We have increased the amount of puts bought for protection from 0.5% to 2.5%, since we are trying to buy protection only when we expect to truly need it.

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[8] *Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac for S&P 500 and Yahoo Finance for VIX.*

Figure 27: Excess return above that of the HFRI FoF Composite Index obtained from spending 2.5% of the index NAV on ATM S&P 500 puts in months when the monthly VIX average, either one or two months earlier, lay in the third daily VIX quartile, continuously updated
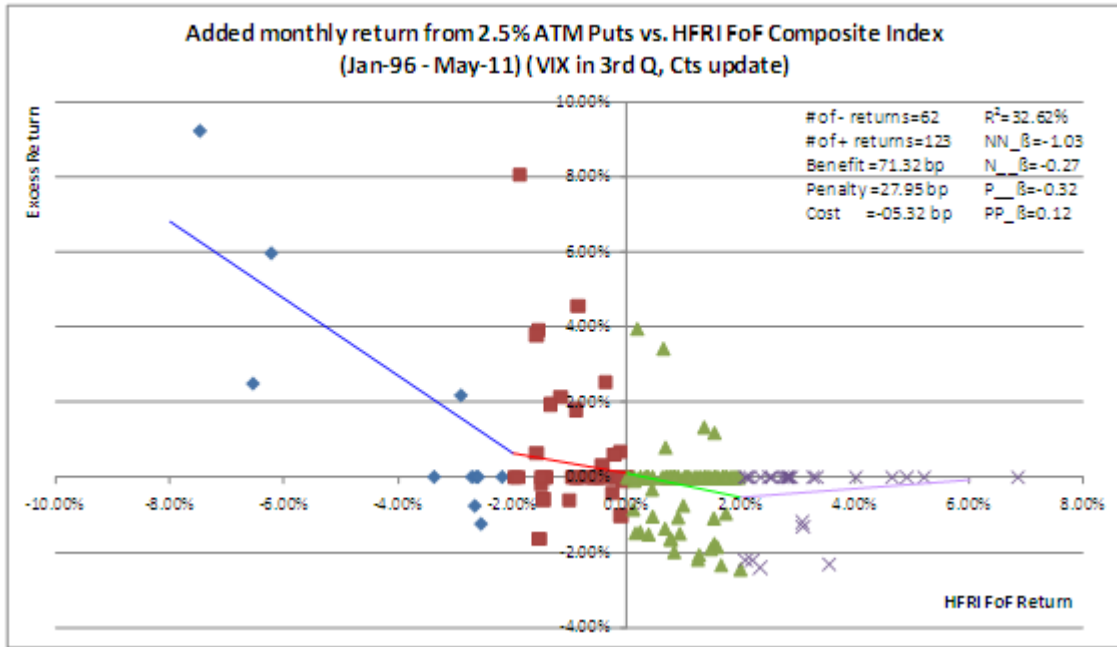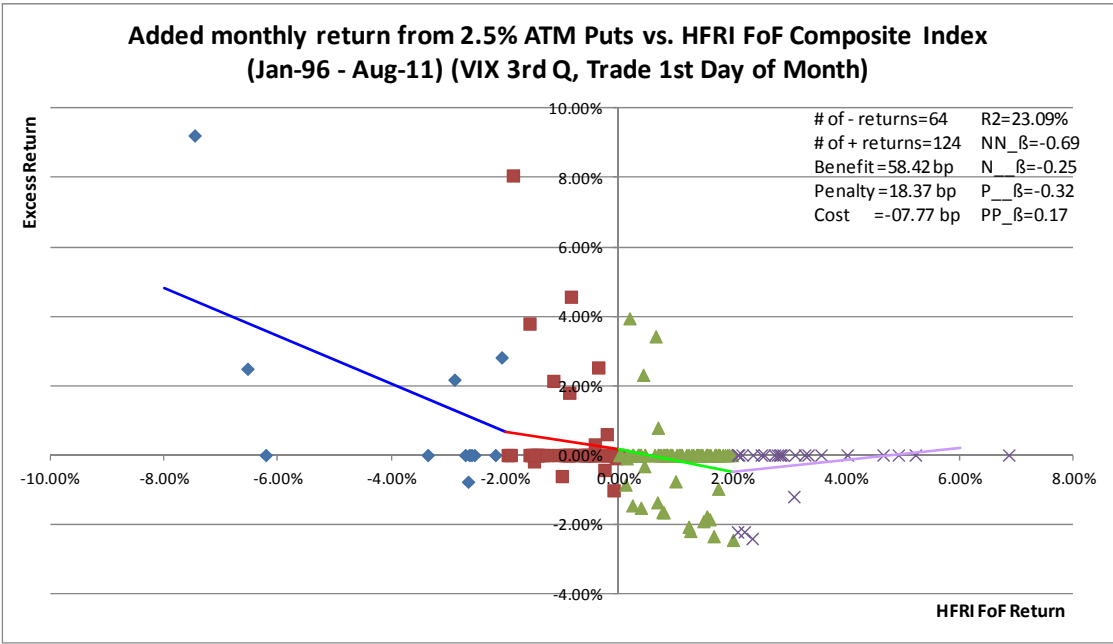

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from OptionMetrics regarding Put options

Note that this strategy has produced a negligible cost of about -5 bp and a β_{HFRI} of about 1, almost perfect protection against large downward HFRI monthly moves. The returns on the strategy have been mostly positive for downward HFRI moves (the left side of the graph) and mostly close zero for positive HFRI moves.

Figure 28 shows the excess return for a similar strategy, differing from the case above in that we ignore VIX levels two months earlier, and buy puts at the start of a month only if the VIX was in the third quartile the previous month. This works almost as well, and is simpler to implement. The historical cost is the same, while the β_{HFRI} of the strategy is only 30% lower. Figure 29 displays the results of a modified and more realistic overlay strategy that allows the purchase of puts on *any* day (not just the start of the month) provided the average VIX level over the previous month lay in the third quartile.

In contrast, Figure 30 shows the effect of spending 2.5% of the HFRI NAV at the start of *every month*, no matter what quartile the daily VIX was in previously. In that case the cost of the strategy rises to a prohibitive 53 bp per month. Inspection of the right side of the graph shows that many of the points that produced zero excess return in Figures 27 and 28 (when puts weren't bought) now migrate downwards to produce negative excess returns of about -2%, corresponding to puts that were bought when protection turned out be unnecessary.

Figure 28: Excess return above that of the HFRI FoF Composite Index obtained from spending 2.5% of the index NAV on ATM S&P 500 puts in months when the average of the VIX over the previous month lay in the third quartile of the daily VIX levels, continuously updated

Added monthly return from 2.5% ATM Puts vs. HFRI FoF Composite Index (Jan-96 - Aug-11) (VIX 3rd Q, Trade 1st Day of Month)

# of - returns=64   R2=23.09%
# of + returns=124   NN_ß=-0.69
Benefit=58.42 bp   N__ß=-0.25
Penalty=18.37 bp   P__ß=-0.32
Cost   =-07.77 bp   PP_ß=0.17

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from OptionMetrics regarding Put options

Figure 29: Excess return above that of the HFRI FoF Composite Index obtained from spending 2.5% of the index NAV on ATM S&P 500 puts on any day when the average of the VIX over the previous month, lay in the third quartile of daily VIX levels, continuously updated. Since we allow the purchase of puts on any day, and puts are sold exactly one month later, often in the middle of a month, we add any return earned from the put to the HFRI return of the month the put is sold.

Added monthly return from 2.5% ATM Puts vs. HFRI FoF Composite Index (Jan-96 - Aug-11) (VIX 3rd Q, Trade Any Day)

# of - returns=64   R2=28.75%
# of + returns=124   NN_ß=-1.11
Benefit =113.18 bp   N__ß=-0.57
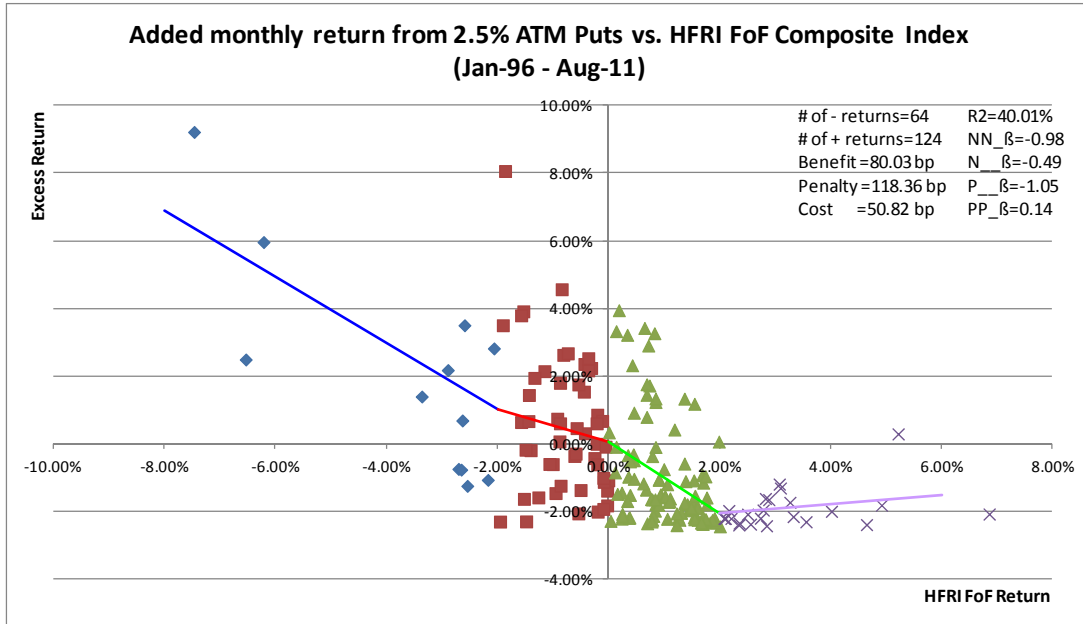Penalty =28.13 bp   P__ß=-0.38
Cost   =-19.97 bp   PP_ß=0.07
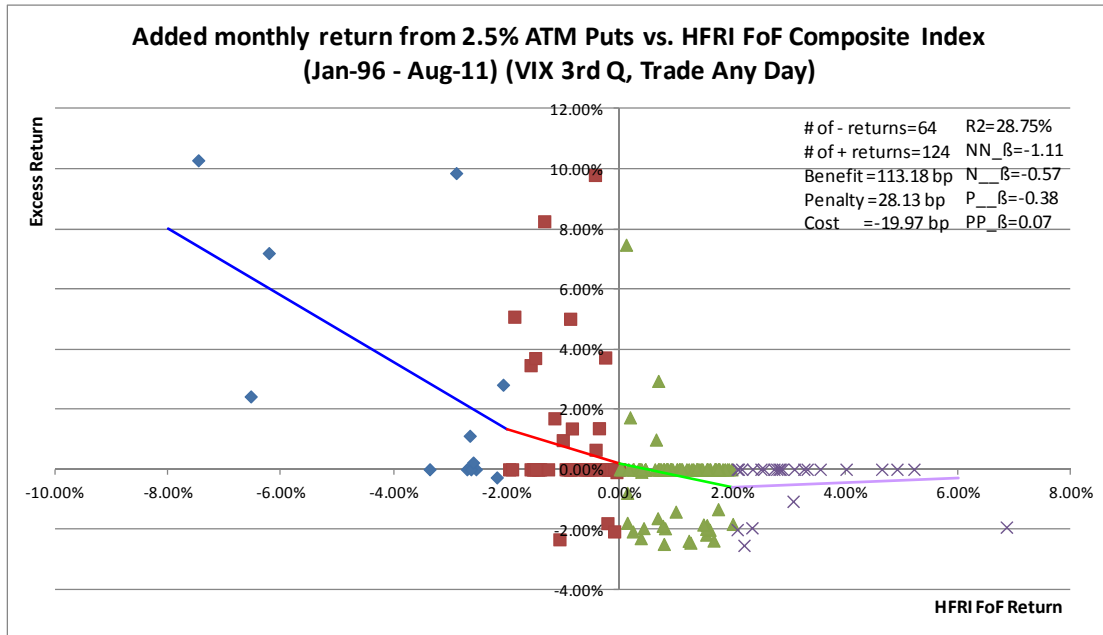
Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from OptionMetrics regarding Put options

Figure 30: Excess return above that of the HFRI FoF Composite Index obtained from spending 2.5% of the index NAV on ATM S&P 500 Puts every month
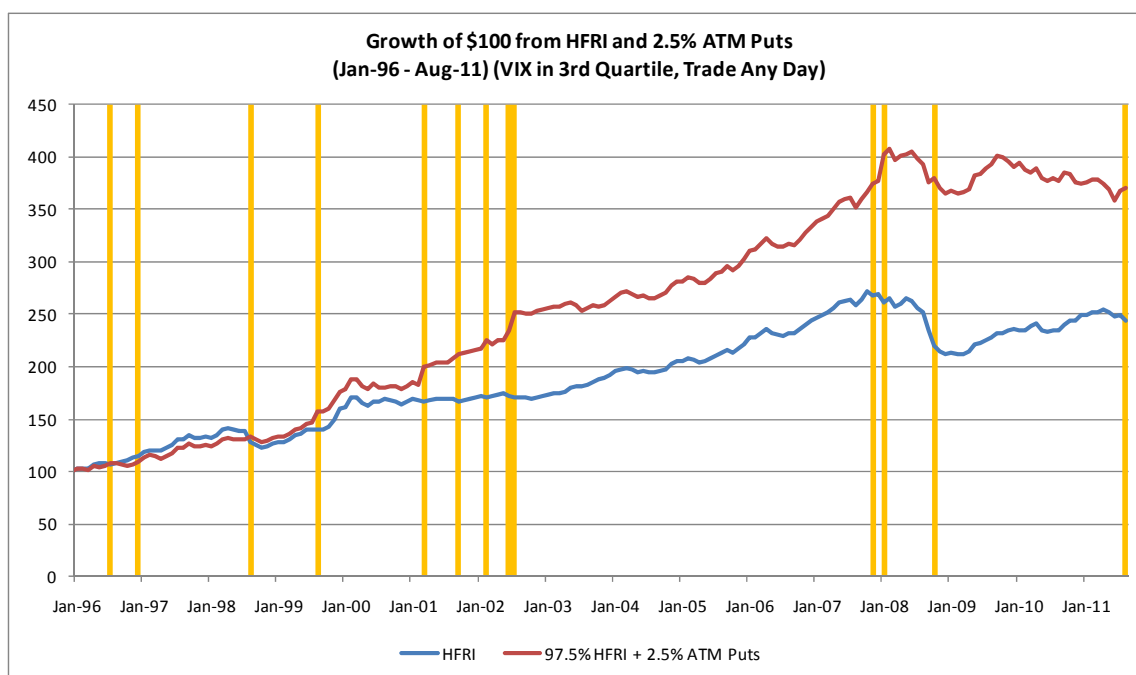

Source: Prisma Capital Partners LP utilizing the methodology described herein and based on underlying data from PerTrac regarding the HFRI and from OptionMetrics regarding Put options

Figure 31 displays the cumulative growth of the VIX-triggered put buying strategy of Figure 27, compared with the HFRI fund of funds growth alone. The VIX-triggered strategy outperforms the fund of funds investment alone, owing to periodic bursts of sharp outperformance during those periods highlighted in yellow in the figure.

Of the strategies we have examined, this VIX-triggered put-buying strategy has been by far the most effective at hedging fund of funds' tail risk but there is of course no guarantee at all that it will perform similarly in the future.

Figure 31: The cumulative growth of an investment in HFRI protected by the purchase of VIX-triggered at-the-money puts. The yellow bands show regions where the buying of puts generated returns of 100% or more, leading to outperformance of the protected portfolio. Between these regions, the protected and unprotected portfolios generated roughly equal returns. Since we allow the purchase of puts on any day, and puts are sold exactly one month later, often in the middle of a month, we add any return earned from the put to the HFRI return of the month the put is sold.

**Growth of $100 from HFRI and 2.5% ATM Puts
(Jan-96 - Aug-11) (VIX in 3rd Quartile, Trade Any Day)**

Legend: HFRI — 97.5% HFRI + 2.5% ATM Puts

Source: HFRI from PerTrac, Put options from OptionMetrics

CONCLUSION

We have investigated a broad variety of downside risk protection strategies for a fund of funds. Table 1 contains a summary of the costs and benefits of the various protection strategies during the periods we have been able to test them.

Table 1: Statistics of protection strategies for the HFRI Composite Index

Protection Type	Strategy	Benefit (bp per month)	Penalty (bp per month)	Cost (bp per month)	β_{HFRI}	γ_{HFRI}
Hedge Fund	Short Bias	24	13	3	0.12	0.18
	CTA (BTOP 50)	7	3	0	0.08	0.47
	Macro	3	-2	-2	0.05	0.39
	Equity Market Neutral	7	3	0	0.03	0.03
Commodity	Gold (2005-2011)	12	-5	-8	-0.03	0.92
	Gold (1990-2011)	7	3	0	0.00	-0.08
	Oil (2007-2011)	39	34	8	0.19	-0.68
	Oil (1990-2011)	15	18	9	0.19	0.53

Protection Type	Strategy	Benefit (bp per month)	Penalty (bp per month)	Cost (bp per month)	β_{HFRI}	γ_{HFRI}
Credit	Barclays Short European Credit	10	7	1	0.06	0.07
Volatility-related	VIX	59	18	4	0.66	4.08
	SPVXMTR	39	18	-2	0.30	1.27
	0.5% ATM Put Buying	16	24	11	0.20	0.73
	0.5% 5% OTM Put	4	34	21	0.35	1.27
	0.5% 20% OTM Put	-20	45	37	0.45	1.46
	-0.5% ATM Straddle	-37	85	69	0.82	2.34
	2.5% VIX-triggered Put Buying (1st Day)	58	18	-8	0.69	5.00
	2.5% VIX-triggered Put Buying (Any Day)	113	28	-20	1.11	7.45
	2.5% ATM Put (all)	80	118	51	0.98	3.68

Source: Short Bias, Macro, Equity Market Neutral: PerTrac; CTA (BTOP50): barclayhedge.com; Gold: kitco.com; Oil: eia.gov; Barclays Short European Credit: ecommerce.barcap.com; VIX: Yahoo Finance; SPVXMTR: Bloomberg Terminal; Options: OptionMetrics

Table 1 illustrates that allocations to CTA or Macro hedge funds can be helpfully convex hedges, but only during prolonged momentum-driven crises. Gold is useful in the face of fear of inflation and excesses of fiat money. Oil is a hedge against inflation and Middle East politics. CDS trading is useful against credit collapses and their correlation with equity levels. All of these hedges are tactical and require timing. There is no single panacea. Volatility, in contrast, holds the most chance of being a generic all-purpose crisis hedge, that can react rapidly to sudden unexpected deleterious events. Unfortunately, buying perpetual volatility insurance is damagingly expensive. A 2.5% 3rd-quartile VIX-triggered put buying strategy seems to provide a statistically good combination of minimal cost, optimal β_{HFRI} and appreciable convexity, but, as usual, past performance is no guarantee of future success.

The construction of carefully diversified portfolios of specialized strategies, modified according to expected economic conditions is critical before trying tactical tail hedges. Buying insurance comes after building the best barn you can.

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