

Tail Risk Hedging

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Abstract

Many investors have significant long equity market exposure and seek effective portfolio protection. Several strategies for tail risk hedging have been proposed to provide downside protection in equity market sell-offs, notably a) increasing fixed income allocation, b) buying protective puts through the sale of out-of-the-money calls (*collars*), c) hedging using VIX futures, and d) allocating to Managed Futures or other alternative risk premia strategies. In this paper we examine the popular strategies for tail risk hedging and highlight the cost-benefit of each.

Keywords

Tail Risk; Hedging; Diversification; Trend Following

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1. Introduction

In statistics “tails” are defined as the extremes of a distribution (i.e., those outcomes that have a small probability of occurring). In finance the term *tail events* typically refers to infrequent, out-sized downside market moves such as those observed during the 2008 financial crisis. There is no broadly accepted definition of what constitutes a tail event, but consensus holds that we see moves larger than those expected by financial models, approximately every 3–5 years on average. In recent years equity markets have soared and investors are increasingly looking to have a hedge against their equity exposure. Because tail events are difficult to predict, and by their extreme nature can have a profound impact on a portfolio, protection from tail events can be a valuable component of a diverse portfolio.

Tail Risk Hedging

Even supposedly diverse portfolios are often susceptible to significant risk associated with a sustained fall in equities prices. Traditionally, investors have used fixed income to offer some protection during equity bear markets. It has been observed that equities and bonds show a high negative correlation during times of exceedingly high volatility [Connolly et al. (2005)]. Therefore, increasing fixed income allocation in a portfolio has been advocated to help mitigate the downside exposure of equities in times of high market risk. There are potential pitfalls inherent in this strategy. For example, a classic 60-40 equities-bond portfolio effectively equates to over a 90-10 allocation in terms of realized risk with equities dominating bonds. As a result, the protection offered by the fixed income allocation may be less than anticipated. One way to address this is through the construction of a risk-parity portfolio where equities and bonds have equal risk allocations.

Some market participants use options to try to mitigate tail risk. For example, a traditional capital preservation strategy like a *collar* works by selling out of the money calls, and using the premium to buy out of the money puts. This effectively sets a floor and ceiling to potential profit and loss from movements of the underlying asset.

VIX Futures provide another volatility-based indirect hedg-

ing strategy. The VIX index tracks the volatility of S&P 500 options and is commonly referred to as the “fear gauge” of equity markets. It is an aggregation of the implied volatilities of the puts and calls that expire approximately within a month’s time. Equity market sell-offs are typically accompanied by a spike in market volatility. For example, during the market uncertainty of 2008, the VIX surged to historical highs over the course of two months as markets fell. By going long VIX futures contracts in an appropriate hedge ratio, one can hedge exposure to the underlying equity market.

Commodity Trading Advisors (CTAs) attempt to capture trends in futures markets. CTAs tend to have low correlation to equity assets, and as such they can be used to mitigate risk in an equity-dominant portfolio. The directional nature of such funds can potentially lead to high returns in times of market stress.

2. Methodology

In this paper we will evaluate various tail risk hedging strategies to measure their effectiveness. The base comparison case is a 60-40 portfolio with a 60% allocation to the S&P Total Return Index (SPTR) and 40% allocation to the US Aggregate Bond Index (LBUSTRUU). The four strategies we consider are:

1. Risk-Parity: a portfolio having equal risk allocation to SPTR and LBUSTRUU instead of 60-40 allocation of capital.
2. Collars: a portfolio replacing long exposure to S&P 500 in the base portfolio with a 60% allocation to CLL Index (95-110 Collar) instead of SPTR.
3. VIX Futures: a portfolio where we hedge 10% of benchmark equity exposure at any given time by going long VIX futures.¹
4. CTA: a portfolio with a 20% allocation to the 20% volatility-targeted BarclayHedge CTA Index.

¹A hedge ratio is calculated based on rolling beta of VIX Futures to S&P 500.

	S&P 500	Baseline 60-40	Risk-Parity	Collar	VIX	CTA
Avg Annual Return	10.9%	9.2%	7.4%	6.7%	6.2%	9.7%
Annual Volatility	14.2%	8.8%	4.3%	6.6%	6.8%	7.9%
Information Ratio	0.77	1.05	1.73	1.02	0.91	1.23
Worst Drawdown	50.9%	31.4%	8.4%	20.8%	25.3%	21.4%
Growth of \$1	\$16.7	\$12.4	\$8.2	\$6.4		\$14.9

Table 1. Summary Table 1988-2017

3. Discussion

Table 1 compares the various hedging strategies starting in 1988. The benchmark 60-40 portfolio has a worst drawdown of 31.4% compared to 50.9% for the S&P 500, and an average annual return of 9.2% (historical drawdowns are plotted in Figure 1).

In comparison, the risk-parity portfolio of stocks and bonds has the lowest drawdown but also reduces the average returns due to much lower volatility of the fixed income allocation. It also has the highest Information Ratio (IR) among all the evaluated hedging strategies. However, the high IR of risk-parity can in part be explained by an unprecedented drop in bond yields over the 30 year backtest period that is unlikely to be repeated in a rising rate environment. Increasing fixed income allocation to protect against equity sell-offs only works under the assumption that equities and bonds maintain their negative correlation. However, this has not been true historically for long periods of times [see GCM research note on equity-bond correlation]. Risk parity also makes use of leverage to deliver higher volatility, which can exacerbate drawdowns in periods of simultaneous bond and equity market sell-offs.

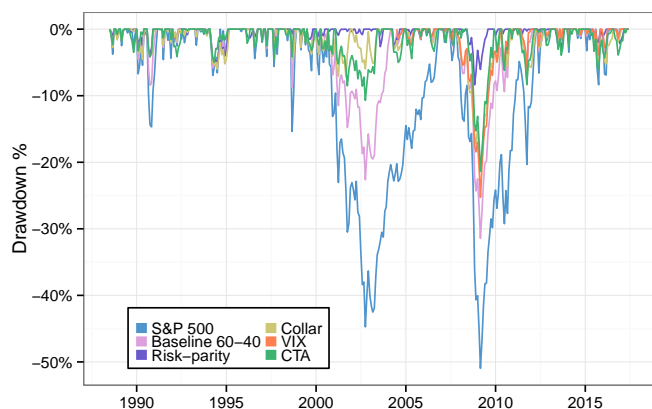


Figure 1. Historical drawdowns of tail risk hedging strategies.

A collar hedging strategy has a similar IR as the 60-40 benchmark portfolio and a significantly lower worst drawdown of 20.8%; however, it results in significantly lower cumulative wealth. Buying collars eliminates much of the potential upside from equity rallies and this can be further compounded by the high transaction costs associated with trading options.

Hedging with VIX futures² looks superficially similar to the collar hedging strategy. Compared to the benchmark portfolio it gives a lower IR albeit with a better drawdown profile. Some protection is afforded by the negative correlation between VIX

futures and equities, but VIX futures are often in a state of contango and the negative roll yield associated with the hedge position can act as a drag on the portfolio.

The CTA hedging strategy exhibits higher cumulative wealth and IR than does the benchmark, along with an improved drawdown profile. Historically CTAs have performed well during crisis periods for equities as they can take short positions in downward trending markets. Unlike some of the other hedging strategies described here, CTAs can also see significant positive returns when equity markets are doing well, and as a result are less likely to detract from performance during strong periods for equities.

Table 2 examines the performance of tail risk hedging strategies in the ten worst S&P 500 months. We find that all of them outperformed the 60-40 benchmark in every single instance.

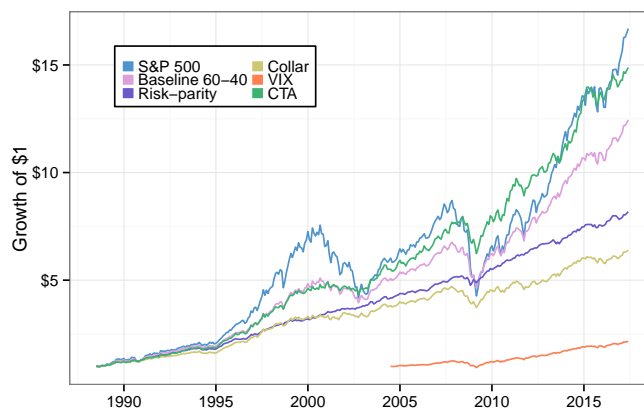


Figure 2. Cumulative growth of \$1 invested in portfolios with different tail risk hedging strategies.

Charting cumulative growth of \$1 in Figure 2 has the CTA hedged portfolio outperforming all other hedging strategies by a wide margin. CTA allocation is able to deliver high volatility in combination with uncorrelated alpha to give nearly the same total wealth as does the S&P 500. Direct hedging using options decisively gives the lowest returns out of all the strategies. The risk-parity portfolio can't compensate enough for low volatility with its high IR and gives lower terminal wealth than does the benchmark.

²VIX Futures data available from 2004

	S&P 500	Baseline 60-40	Risk-Parity	Collar	VIX	CTA
Worst ten S&P 500 months						
10-2008	-16.8%	-10.7%	-4.7%	-3.2%	-7.2%	-6.7%
08-1998	-14.5%	-8.2%	-0.7%	-4.1%		-3.6%
09-2002	-10.9%	-6.0%	0.1%	-1.4%		-3.8%
02-2009	-10.6%	-6.5%	-1.4%	-3.4%	-5.7%	-5.4%
02-2001	-9.1%	-5.2%	-0.6%	-4.5%		-4.5%
08-1990	-9.0%	-6.0%	-3.3%	-3.4%		-3.0%
09-2008	-8.9%	-5.6%	-2.6%	-4.6%	-4.4%	-4.6%
06-2008	-8.4%	-5.1%	-1.8%	-4.8%	-4.6%	-3.0%
01-2009	-8.4%	-5.3%	-1.6%	-3.6%	-4.5%	-4.4%
09-2001	-8.1%	-4.4%	-0.3%	3.7%		-2.7%
Average	-10.5%	-6.3%	-1.7%	-2.9%	-5.3%	-4.2%

Table 2. Tail risk hedging strategies outperform Benchmark portfolio in worst S&P 500 months (1988-2017)

4. Conclusion

In this paper we evaluated four tail risk hedging strategies – increasing fixed income allocation, direct hedging using options, VIX Futures, and CTAs. Increasing fixed income allocation to form a risk-parity portfolio has historically achieved a very high IR and good tail protection, but significantly lower terminal wealth. Volatility based hedging strategies have lower IR than benchmark portfolio and realize lower volatility leading to lower cumulative growth. Finally we find that CTAs provide a high degree of tail protection, with higher IR and similar volatility to a 60-40 benchmark.

References

Connolly, Stivers, and Sun. Stock market uncertainty and the stock-bond return relation. *The Journal of Financial and Quantitative Analysis*, 40(1):161–194, 2005.

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