

Bounding Beta

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Abstract

Trend-following strategies offer diversification benefits with their inherent low correlation to equities. Their potential to be long equities when markets rally can pose challenges for asset owners, however, who can only accommodate limited equity exposure. Other investors may even seek trend-following strategies with negative correlation to equities in the hope of added protection in negative equity markets. In this note we address ways of modifying equity exposure to achieve such goals.

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1. Introduction

Many asset owners appreciate the diversification benefits of trend-following strategies given the inherent low correlation and convexity to underlying risk assets such as equities. Trend-following tends to be unbiased to being long or short equities, and, dependent on market moves, will be both long and short these markets for part of the time leading to near zero long-term correlation to equities. Despite this, even such transitory long equity exposure can be problematic for asset owners who are at their portfolio limits in terms of (long) equity exposure. Furthermore, other investors may have a preference to accessing trend-following strategies that have been modified to have a negative correlation to equities with the hope of increasing protection in negative equity markets. In both these instances, imposing asymmetric limits on (long) equity exposure may offer a solution that is helpful.

In this paper we look at ways in which equity exposure may be modified and contrast the application of an outright exposure cap with a beta cap. We also show that for those that aim to modify the correlation to equities, any beta cap needs to also consider the target volatility of the strategy. Throughout this note we employ a simple trend-following strategy, trading a broad and liquid universe of futures markets. We calculate our equity market beta and correlation with respect to the S&P 500 as an equity benchmark.

2. Controlling Equity Market Exposure

Arguably the easiest way of controlling equity market exposure is to not trade equities at all. But given the ability of trend-following to also profit in falling equity markets, this fairly crude approach is rarely the method of choice. In addition, equity exposure can arise from trading other markets that at times can become highly correlated to equities.

Any market's and indeed any portfolio's equity exposure can be measured by calculating its *beta* to a given equity *benchmark*. The beta of a market (or portfolio) *a* to a benchmark *b* can be expressed as

$$\beta = \rho \frac{\sigma_a}{\sigma_b},$$

where ρ is the correlation between them and σ_a and σ_b are their volatilities. We see that the beta is equal to the correlation be-

tween the market (or portfolio) and the chosen benchmark, if their volatilities are the same. And a portfolio consisting just of being long the benchmark would trivially result in a beta of one, as its returns would move in sync with the benchmark. A variety of sensible benchmarks exist, here we chose the S&P 500 as a representative equity market.

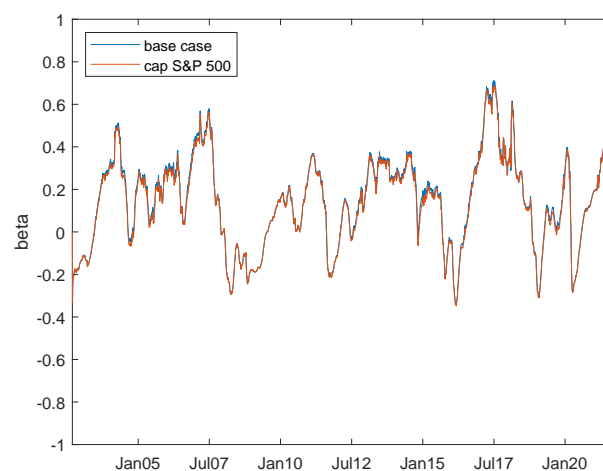


Figure 1. Rolling equity market beta of a trend-follower that caps S&P 500 exposure at zero. The overall beta is nearly unaffected.

The most obvious way of limiting the beta of a portfolio is to prohibit it from going long the S&P 500, that is imposing an *exposure cap*. Figure 1 shows the equity beta of a simple trend-follower for which the S&P 500's exposure has been capped at zero. Contrasting this with the result for an uncapped trend-follower, we find almost no impact on the portfolio equity beta. We see in Figure 2 that this is a result of exposure moving to other highly correlated equities: when the exposure cap on the S&P 500 is active, there is a corresponding positive increase in exposure in the other US equity indices. Simply capping the exposure to the benchmark asset is therefore not a viable option if equity exposure in general is sought to be limited. This approach may be useful only if an investor needed to control their exposure to a single equity market rather than equities overall.

If the exposure to equities needs to be controlled more generally, then capping all equity markets will naturally have a greater

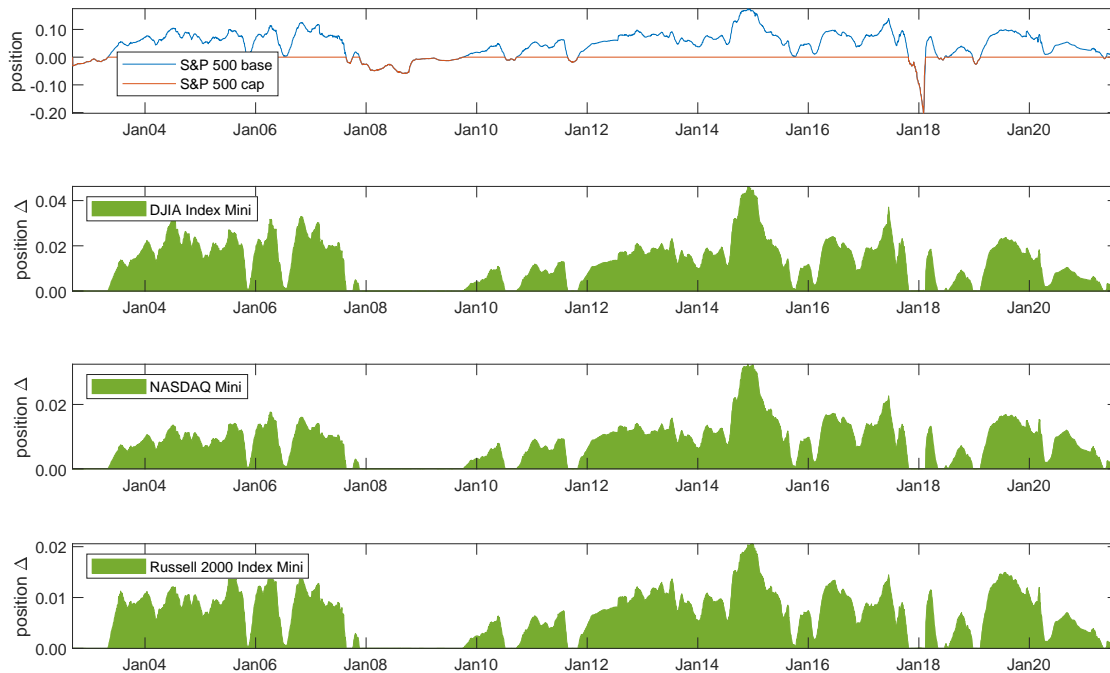


Figure 2. Position for the S&P 500 in the uncapped and capped case, as well as position *difference* between capped and uncapped case for some highly correlated equity markets. Exposure capping the S&P 500 leads to nearly commensurate increases in positions of the Dow Jones, Nasdaq and Russell.

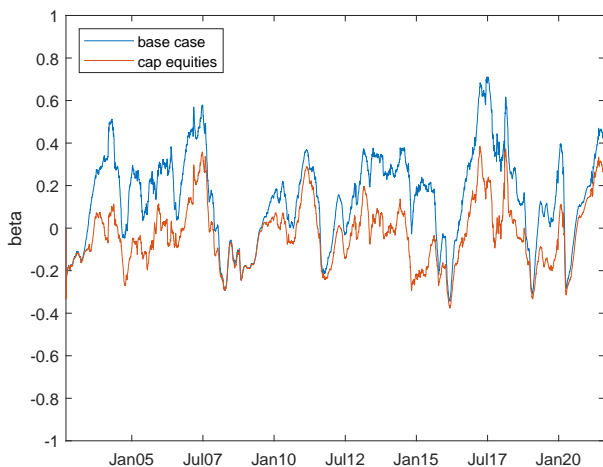


Figure 3. Rolling equity market beta of a trend-follower that caps equity exposure at zero.

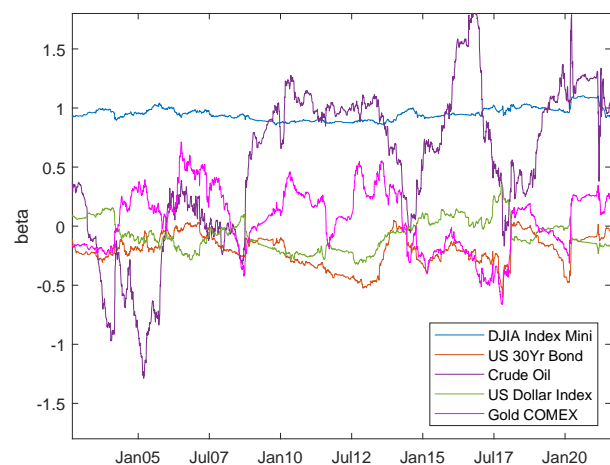


Figure 4. Rolling equity market beta of various markets from different sectors.

impact than capping just a single market, as is illustrated in Figure 3. A concern of constraining exposure this way is that pseudo-equity market exposure is still assumed at overall portfolio level by the strategy taking amplified positions in other risk assets that are correlated, or more specifically have non-zero equity market beta. Figure 3 clearly shows a significant positive equity market beta, despite equity market exposure itself being capped at zero. Here this results from a shifting of exposure to bonds, for example, which typically have negative beta to equities, see Figure 4.

This graph also illustrates that seemingly unrelated markets can exhibit significant beta.

These results suggest that capping the equity beta directly by imposing a beta constraint in the portfolio is a more effective option than capping exposure in the vast majority of cases. By recognizing that various markets can have positive (or negative) equity beta, and that this beta is time varying, we can constrain the portfolio such that its beta does not exceed zero, see Figure 5. Note also that adjusting portfolio exposures ex-ante such that a

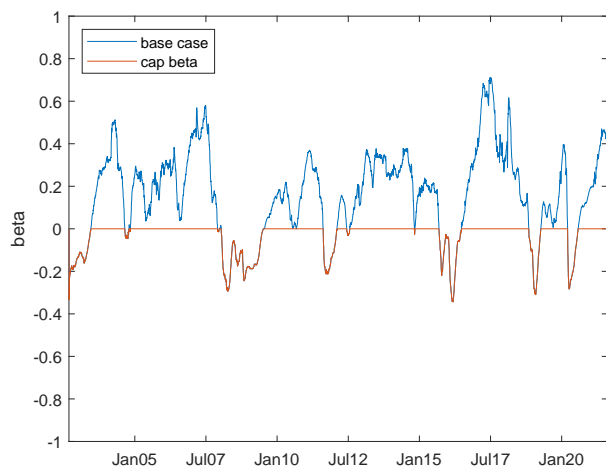


Figure 5. Rolling equity market beta of a trend-follower that caps equity market beta at zero at the portfolio level.

desired beta level is not exceeded is preferable to ex-post hedging which is expensive; it avoids entering positions only to take them off subsequently.

3. Non-Zero Beta Capping

Rather than drastically constraining a portfolio by capping the beta at zero, it is sometimes advantageous to soften this constraint to a non-zero cap. This would make beta capping attractive to investors interested in risk mitigation, who are willing to miss out on some upside in equity bull markets if this can gain ‘crisis risk offset’ on the other side. In such instances it is useful to highlight the trade-off in upside (reduction in positive return) versus the impact on correlation and downside ‘protection’. As a result of the relationship between the beta and the ratio of volatilities between the portfolio in question and the benchmark, we find that the lower the volatility of the strategy, the less impactful a beta cap will be. In other words, more restrictive beta caps are needed for less volatile strategies than on more volatile strategies to achieve the same impact on correlation.

This effect is illustrated in Figure 6. We apply a non-zero beta cap of 0.2 to trend-following portfolios with different annualized volatilities, 8% and 15%. The correlation to the S&P 500 is seen to be lower in the higher volatility case throughout the backtest. The average correlation drops by about 5 percentage points, with the correlation difference larger than that in times when the beta cap is active, i.e. when the beta and correlation are positive.

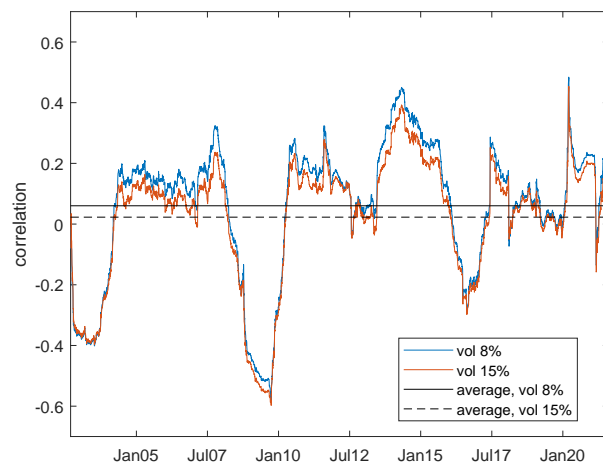
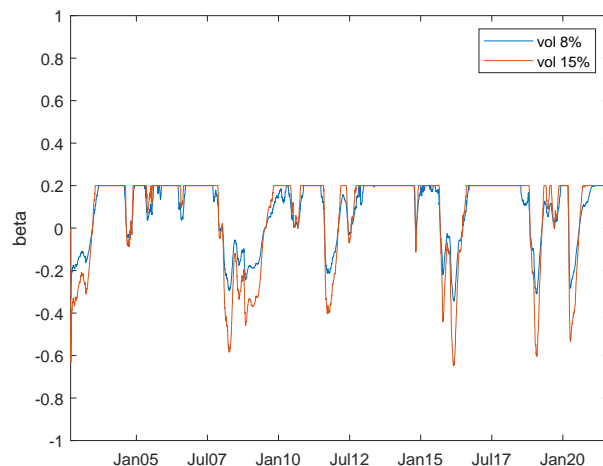


Figure 6. Capped beta portfolio at different volatilities. While the beta cap is set at the same non-zero level, the correlation to the S&P 500 differs between the strategies, and is found to be lower in the higher volatility case.

4. Conclusion

In this note we have outlined various approaches to controlling equity market exposure, ranging from capping market exposure to capping the portfolio beta. In most practical applications, a hybrid approach, placing caps on both exposure and beta, is desirable, allowing for tighter control and better portfolio management in the light of other limitations such as exposure and trading limits.

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