Timing Leveraged Equity Exposure in a TAA Model

How a Simple VIX-based Filter Boosts Returns and Reduces Drawdown

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Hi there,

Leveraged ETFs like SPXL and TQQQ are built to deliver a multiple of daily index retur They can produce spectacular gains in trending markets, but are vulnerable to volatili drag when conditions turn choppy. Because leverage is reset daily, compounding effec accumulate over time, often leading to underperformance in volatile, mean-reverting markets, but sometimes generating outsized returns in calm, trending markets.

Quantpedia recently highlighted this dynamic in their article [Leveraged ETFs in Low-Volatility Environments](#) (drawing inspiration from [Zarattini et al., 2025](#), on volatility-based strategies), showing how a simple filter that compares realized and implied volatility can improve the timing of leveraged equity exposure.

In this piece, I extend those insights by integrating a volatility filter, with some modifications, into the Tactical Asset Allocation (TAA) model I've discussed [before](#). The goal is to better time allocations between leveraged equity (e.g., SPXL) and cash. The results show meaningful improvements in CAGR, Sharpe ratios, and drawdowns.

```
=== Summary Statistics ===
                        With VIX Filter  Without VIX Filter    SPY
CAGR                              25.23               23.46  16.38
Ann. Volatility                   16.38               17.33  17.90
Max Drawdown                     -16.55              -22.00 -33.72
Sharpe Ratio                       1.38                1.23   0.87
Correlation with SPY               0.49                0.61   1.00
Drawdown-to-Vol Ratio             -1.01               -1.27  -1.88
```

Let's dig into the details.

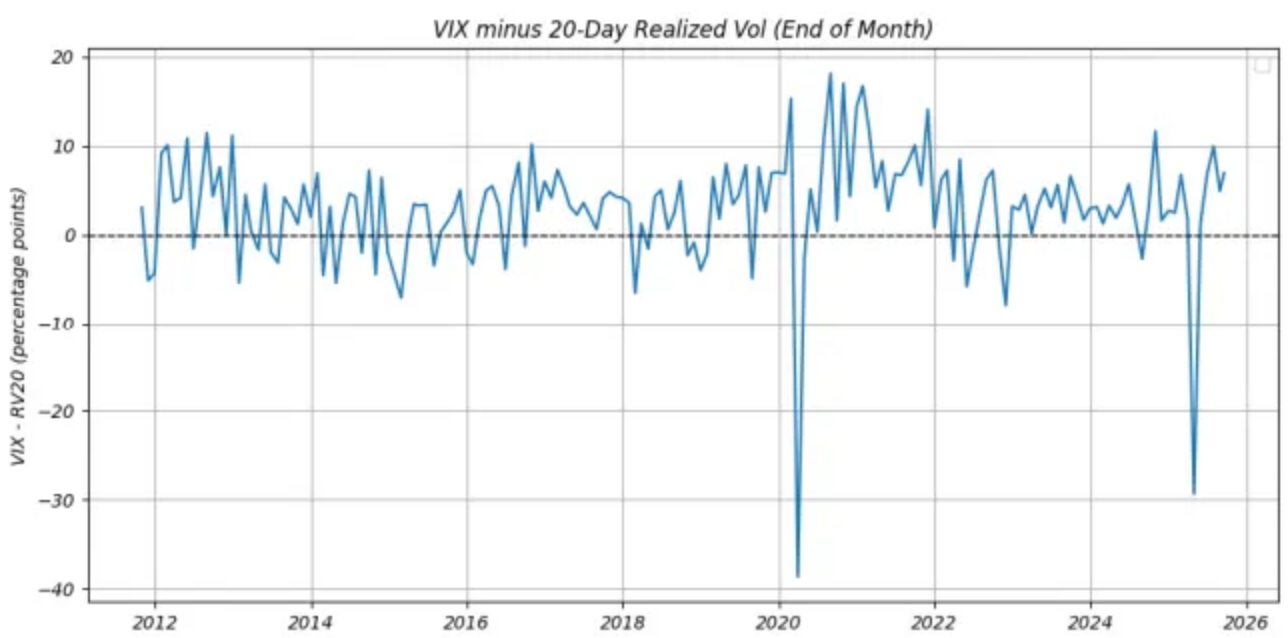
Background

Quantpedia's article studies a simple volatility filter to improve the timing of leverag equity exposure. The filter compares short-term realized volatility of the S&P 500 w implied volatility derived from the VIX. When implied volatility exceeds realized volatility, which is typically a sign of "normal" markets, the strategy allocates into leveraged long equity (SPXL). Conversely, when realized volatility surpasses the VIX, exposure is reduced or avoided.

In backtests spanning 2013–2025, Quantpedia finds that this approach improves bo absolute and risk-adjusted performance, particularly when realized volatility is measured with a longer window (e.g., 20 days) and the VIX is averaged over a short horizon (e.g., 10 days). The resulting Sharpe and Calmar ratios demonstrate a notab improvement over naive buy-and-hold exposure in leveraged ETFs.

The spread between implied and realized volatility is commonly referred to as the volatility risk premium (VRP). On average, implied volatility tends to exceed realized volatility, creating a premium that accrues to volatility sellers. However, this relationship often inverts during periods of market stress. Such episodes are freque associated with inversions of the VIX term structure, a topic I discussed here.

The chart below plots the difference between the VIX and 20-day realized volatility past SPY returns, sampled at each month-end. This is also the main signal used belc The series is positive in 78% of observations, but marked by sharp negative spikes during crises such as the COVID-19 selloff. Beyond these headline episodes, there a also numerous smaller instances of stress when the VRP briefly turns negative.



VIX Filter and the TAA Model

Let's now bring these insights into the Tactical Asset Allocation (TAA) model I've discussed in earlier posts (see here and the subsequent robustness checks for detai

In its standard form, the TAA model uses SPY as the fallback asset. As a variation, I'v instead in several posts also used leveraged equity ETFs such as SPXL or TQQQ in order to boost long-run CAGR. However, as is well known, leveraged ETFs are particularly vulnerable to volatility drag during turbulent, mean-reverting periods. T makes them natural candidates for a volatility-based timing overlay.

The idea is simple: Use the volatility risk premium, the difference between implied a realized volatility, to decide whether the fallback allocation should go into leverage equity or instead be held in cash. The only real parameter to set is the lookback horizon used to compute the realized volatility of SPY. Following Quantpedia, and consistent with the one-month horizon embedded in the VIX, I use a 20-day lookba as the baseline.

The monthly rebalancing signals are then straightforward:

- **If realized volatility (20-day) < VIX → allocate fallback to SPXL**
- **If realized volatility (20-day) > VIX → allocate fallback to cash**

Allocations to the other assets in the model (TLT, GLD, DBC, UUP, BTAL) remain unchanged. Only the fallback allocation toggles between leveraged equity and cash depending on the VRP signal.

At each month-end rebalancing, I use only information available up to the previous trading day, both in terms of returns and the VIX, to avoid lookahead bias. Transacti costs are set at 5 basis points per trade. The study relies on daily ETF price data fron EODHD and VIX data from FirstRate Data.

The figures below report performance statistics for the strategy with and without th VIX filter, along with plots of cumulative returns and drawdowns. For comparability,

both return series are scaled to a 10% annualized volatility.

```
=== Summary Statistics ===
                      With VIX Filter  Without VIX Filter    SPY
CAGR                            25.23               23.46  16.38
Ann. Volatility                 16.38               17.33  17.90
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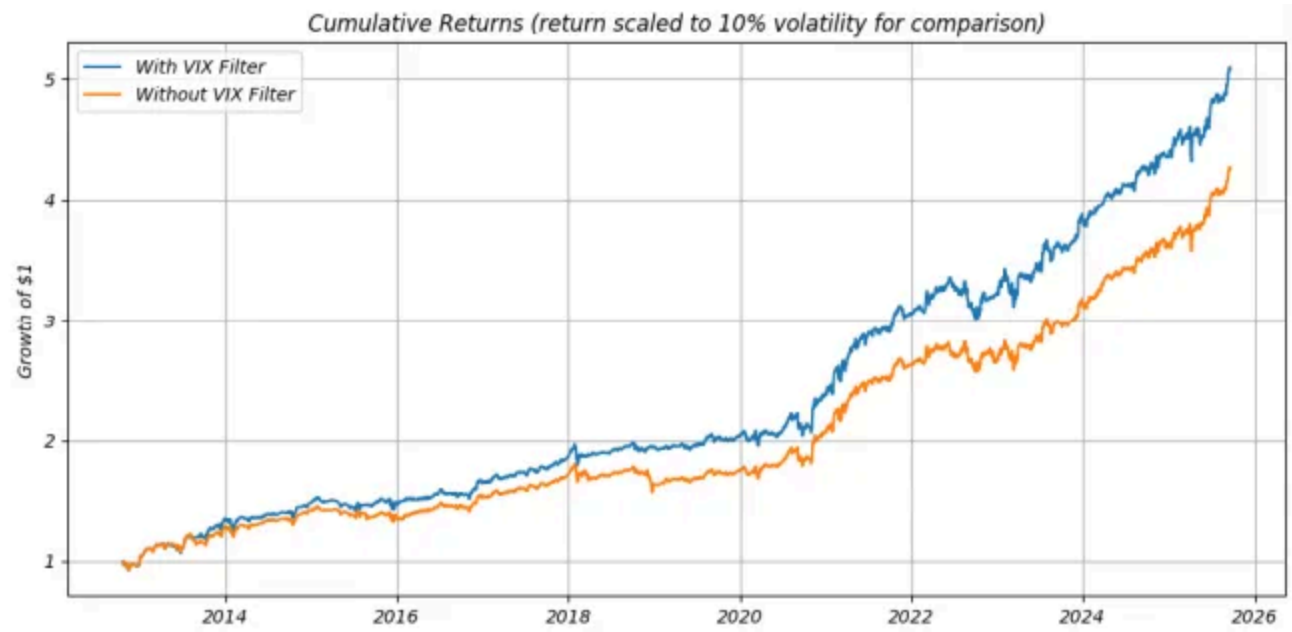
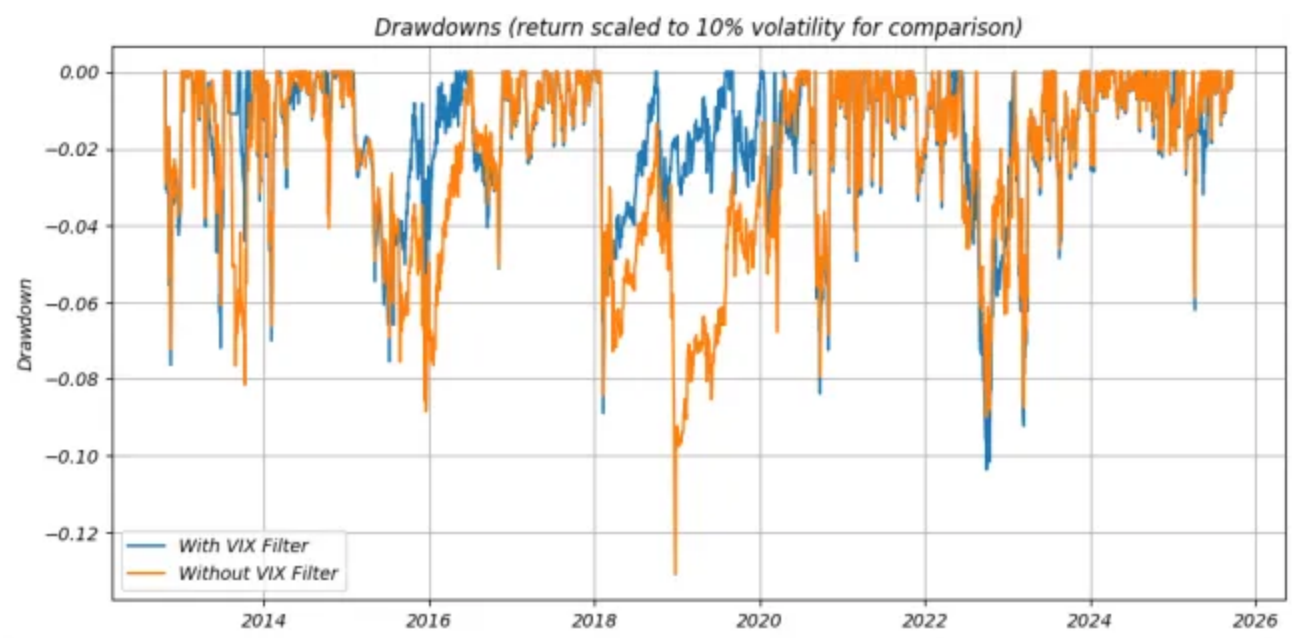




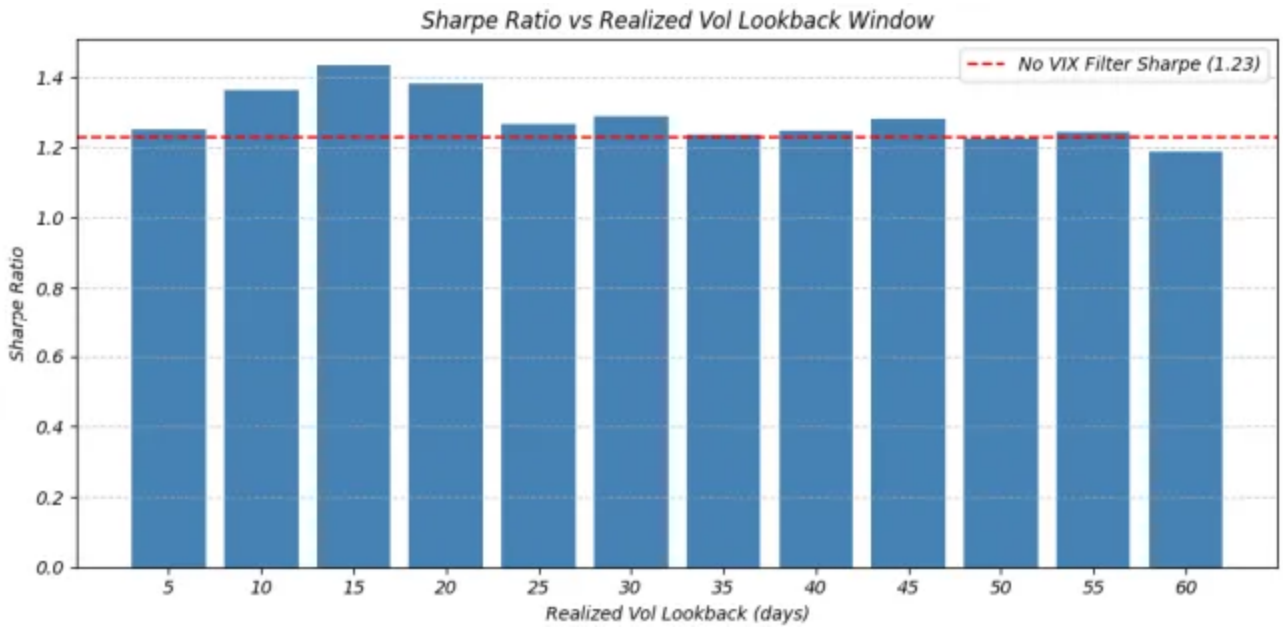
```
=== Average Weights ===
      With VIX Filter  Without VIX Filter
TLT             0.141               0.141
GLD             0.166               0.166
DBC             0.151               0.151
UUP             0.129               0.129
BTAL            0.116               0.116
SPXL            0.251               0.297
Cash            0.046               0.000
```

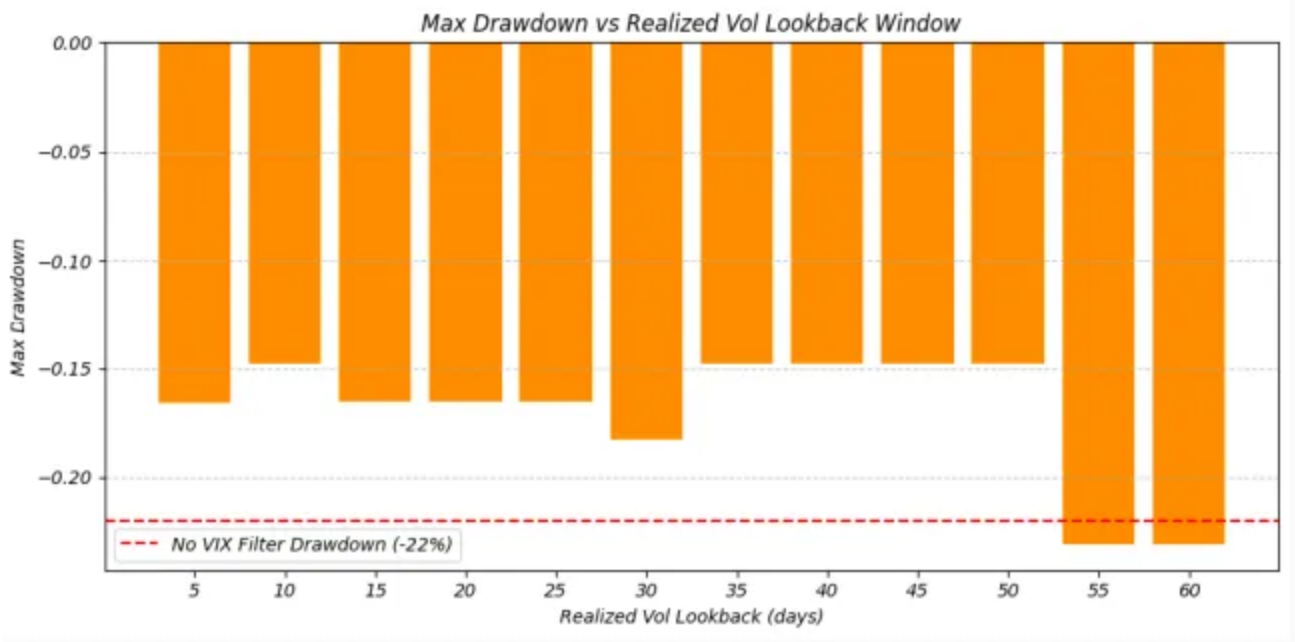
Adding the VIX filter raises CAGR to above 25%, lifts the Sharpe ratio from 1.23 to 1 and reduces maximum drawdowns from 22% to roughly 16.5%. The drawdown-to-volatility ratio improves notably, from 1.27 to 1.01. While the impact of the VIX filter was most pronounced during the 2018 selloff, it also provided meaningful protectic during several other periods.

On average, the VIX-filtered strategy allocates 4.6% of capital to cash, suggesting th even modest shifts away from leveraged equity meaningfully improve the risk-retur profile.

Robustness of Realized Vol Measure

A natural question is how sensitive the results are to the choice of lookback when calculating realized volatility. To address this, I test windows ranging from 5 to 60 trading days in 5-day increments and report Sharpe ratios and drawdowns.





The evidence shows that applying the VIX filter improves both Sharpe ratios and drawdowns across nearly all lookbacks. However, shorter horizons up to 20 days deliver the strongest Sharpe ratios, suggesting a more reactive measure is preferrec practice, the precise choice of 10, 15, or 20 days is not critical; all capture the essenc of the signal effectively.

Diversifying Across Vol Lookbacks

However, relying on a single realized volatility window can make the signal sensitive noise or regime shifts. A simple way to reduce this dependence is to diversify across multiple lookbacks, for example, 10, 15, and 20 days. Here is an example of a straightforward allocation rule:

- **If RV of all lookbacks > VIX → allocate 100% of fallback to cash**
- **If 2 lookbacks > VIX → allocate ⅔ to cash, ⅓ to SPXL**
- **If 1 lookback > VIX → allocate ⅓ to cash, ⅔ to SPXL**
- **If all lookbacks < VIX → allocate 100% to SPXL**

This blended approach improves robustness while preserving the spirit of the filter. backtests, it modestly enhances performance, lifting the Sharpe ratio to 1.41 and

reducing maximum drawdowns to around 15%.

```
=== Summary Statistics ===
                      With VIX Filter  Without VIX Filter    SPY
CAGR                            25.68               23.46  16.38
Ann. Volatility                 16.27               17.33  17.90
Max Drawdown                   -14.99              -22.00 -33.72
Sharpe Ratio                     1.41                1.23   0.87
Correlation with SPY             0.51                0.61   1.00
Drawdown-to-Vol Ratio           -0.92               -1.27  -1.88
```

Conclusion

My results indicate that a simple volatility filter, built on the spread between impliec and realized volatility, can substantially enhance leveraged equity allocations within Tactical Asset Allocation framework. By cutting exposure when realized volatility exceeds the VIX, the strategy sidesteps some of the most damaging drawdowns wh still benefiting from the amplified upside of SPXL in calmer, trending markets.

For clarity, I have deliberately kept the signal construction simple to highlight the cc effect. That said, there is scope for refinement. More frequent rebalancing, the inclusion of complementary distress indicators, or allowing the VIX filter to scale allocations smoothly rather than through a binary on/off switch could further impro results. These extensions will be part of my ongoing research.

Finally, for investors who already use TAA frameworks, adding a simple volatility filte could be a low-effort enhancement to time equity exposure that improves risk-adjusted returns without increasing model complexity.

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References

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Zarattini, Carlo, Antonio Mele, and Andrew Aziz, 2025, The Volatility Edge, A Dual Approach For VIX ETNs Trading, SSRN Working Paper 5316487.

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Flo 1d

So you compared historical Volatility of last 20 days vs the avg close of the last 20 days for Vix? T

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AA AA 1d

How much the vol drag from SPXL impacts performance? Just wondering if you substitute for ES the same exposure (or just use SPY with 3x exposure for simplicity) how much better the perform is

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1 reply by QuantSeeker

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