

Research Note: TYVIX/VIX-based Asset Rotation Strategy

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1 Purpose of the document

This document provides succinct descriptions of the strategy index's salient features.

2 Overview of the strategy

The XYZ Index seeks to provide diversified equity and bond market exposure with a dynamic allocation rule that promotes capital preservation and favors assets that are likely to perform well given the volatility environment.

Depending on the volatility environment, the strategy allocates weights across:

1. AGG: a diversified bond portfolio composed of Treasuries, IG corps, mtges, etc.
2. SPY: a diversified equity portfolio composed of large cap stocks
3. IEF: a bond portfolio composed of 7-10 year Treasuries
4. Cash: money market account

3 Volatility-based asset allocation

Option-implied volatility conveys market expectations regarding the level of impending uncertainty in the underlying security returns, and an uptrend in implied volatility may thus herald a period of heightened risk and downside potential. The CBOE VIX and CBOE/CBOT TYVIX—implied volatility indexes for the S&P 500 and 10-year Treasury futures, respectively—serve as broad-based measures of uncertainty in US equity and bond markets. The key finding underpinning the strategy is that the interplay between these two benchmark volatility indexes has historically predicted the relative performance of diversified equities, bonds, and cash. The strategy aims to use this predictive relationship to dynamically adjust exposure across asset classes to achieve superior performance over traditional allocations such as risk parity and the 60/40 rule.

3.1 Volatility regimes

We say VIX or TYVIX is in an uptrend (downtrend) if it has most recently experienced an upward (downward) breakout move. The trend is a function of the index's past 6-month history, so the index could be in an uptrend (downtrend) even if the absolute index level is low (high). Therefore there are 4 volatility regimes that the market could be in:

- Regime 1: TYVIX uptrend, VIX uptrend

- Regime 2: TYVIX uptrend, VIX downtrend
- Regime 3: TYVIX downtrend, VIX uptrend
- Regime 4: TYVIX downtrend, VIX downtrend

To determine which volatility regime the market is in on any given date i , we first define TY_i and VIX_i as the index level of TYVIX and VIX on that day, and define TY_i^U , TY_i^L , VIX_i^U and VIX_i^L as upper and lower bands around the 6-month moving median:

$$TY_i^U = 90\% \text{ quantile of } TY_{i-1}, TY_{i-2}, \dots, TY_{i-126} \quad (1)$$

$$TY_i^L = 10\% \text{ quantile of } TY_{i-1}, TY_{i-2}, \dots, TY_{i-126} \quad (2)$$

$$VIX_i^U = 90\% \text{ quantile of } VIX_{i-1}, VIX_{i-2}, \dots, VIX_{i-126} \quad (3)$$

$$VIX_i^L = 10\% \text{ quantile of } VIX_{i-1}, VIX_{i-2}, \dots, VIX_{i-126} \quad (4)$$

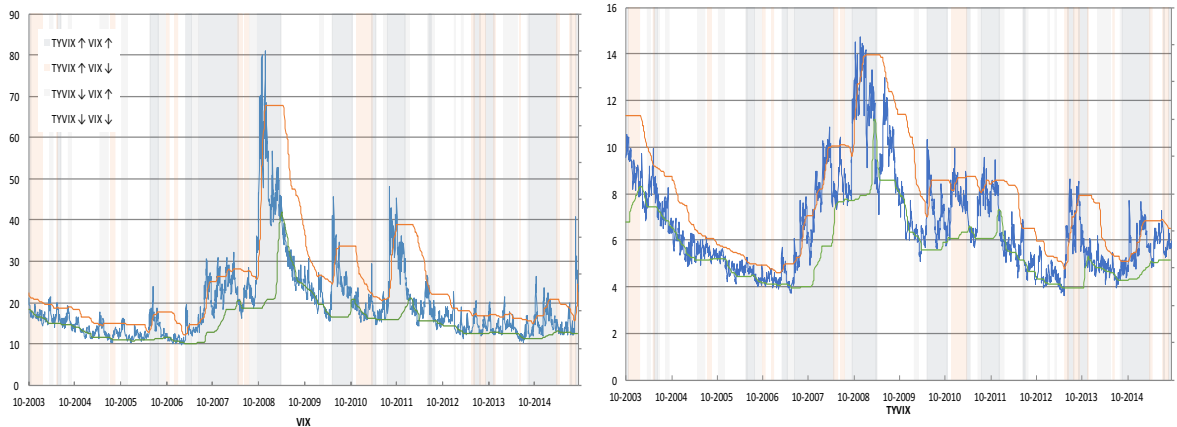
which allows us to define the TYVIX and VIX signals on date i as:

$$S(TY)_i = \begin{cases} 1, & TY_i > TY_i^U \\ 0, & TY_i^L \leq TY_i \leq TY_i^U \\ -1, & TY_i < TY_i^L \end{cases} \quad (5)$$

$$S(VIX)_i = \begin{cases} 1, & VIX_i > VIX_i^U \\ 0, & VIX_i^L \leq VIX_i \leq VIX_i^U \\ -1, & VIX_i < VIX_i^L \end{cases} \quad (6)$$

to dictate the trending status of the indexes as follows:

1. If $S(TY)_i = 1$, then TYVIX is in an uptrend
2. If $S(TY)_i = 0$, then no change in TYVIX's trend
3. If $S(TY)_i = -1$, then TYVIX is in a downtrend
4. If $S(VIX)_i = 1$, then VIX is in an uptrend
5. If $S(VIX)_i = 0$, then no change in VIX's trend
6. If $S(VIX)_i = -1$, then TYVIX is in a downtrend



3.2 Economic intuition behind the 4 volatility regimes

1. Broad Market Panic: TYVIX uptrend / VIX uptrend

Perception of risk is relatively high and either stable or rising in both markets, and Treasuries significantly outperform from a flight-to-quality effect.

2. Isolated Anxiety in Bond Markets: TYVIX uptrend / VIX downtrend

Perception of bond market risk is relatively high and either stable or rising while equity markets are calm, and bonds significantly underperform equities.

3. Isolated Anxiety in Equity Markets: TYVIX downtrend / VIX uptrend

Perception of equity market risk is relatively high and either stable or rising while bond markets are calm. One may guess that equities underperform bonds in this environment, but in fact all assets perform relatively well.

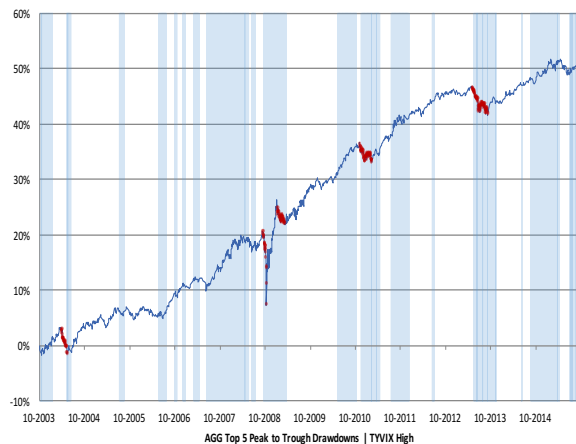
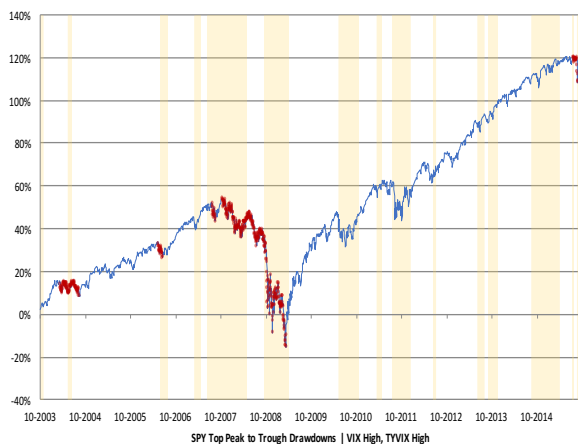
A likely interpretation of this phenomenon is that VIX spikes are more likely to be short-lived when not accompanied by spikes in TYVIX. This regime is usually initiated by a VIX spike, and misses the initial equity loss.

4. Broad Market Calm: TYVIX downtrend / VIX downtrend

Perception of risk is relatively low and either stable or falling in both markets, and all assets have relatively good performance historically.

3.3 Empirical building blocks

- Historically, risk assets perform well when TYVIX is in a downtrend, regardless of VIX's trend status
- Historically, bonds significantly underperform equities when TYVIX is in an uptrend and VIX is in a downtrend
- Historically, equities perform particularly poorly and there's a flight-to-quality into Treasuries when both TYVIX and VIX are in uptrends
- Historically, the most severe risk asset drawdowns happen when both TYVIX and VIX are in uptrends



3.4 Rising rate environment

As to the question of how one may expect the strategy to perform in a rising rate environment¹, there are two likely scenarios that come to mind. If the Fed manages market expectations with respect to its interest rate setting decisions and open market operations, then, *all else equal*, one would expect volatility trends to remain unaffected by this issue.

If, on the other hand, future Fed policies are not properly priced into the equity and bond markets and there's a policy surprise, e.g. FOMC decision, then one would expect TYVIX to experience an uptrend, which puts us in Regime 1 or 2. If VIX is also in an uptrend, then one would expect a risk-off situation in which medium- to long-term Treasuries would rise even if short rates are increased unexpectedly through, for e.g., the Fed Funds target, so the strategy will gain. On the other hand, if VIX is in a downtrend, then there could very well be a bond market-specific sell-off, which the strategy protects against by temporarily parking most of the capital.

The situation in which the strategy may suffer is if bonds sell-off without an uptrend in TYVIX, but economic intuition would suggest that such an event is unlikely.

3.5 Allocation table

To mitigate overfitting risk, we constrain weights to be 0%, 10%, 20%, and 70% in each regime, and arrive at the following allocation table based on the above empirical observations:

Volatility Regime	Weights			
	AGG	IEF	SPY	Cash
TYVIX uptrend, VIX uptrend	20%	70%	10%	0%
TYVIX uptrend, VIX downtrend	0%	10%	20%	70%
TYVIX downtrend, VIX uptrend	70%	20%	10%	0%
TYVIX downtrend, VIX downtrend	70%	10%	20%	0%

¹Here we interpret “rising rate environment” to mean a period of monetary policy tightening and not necessarily referencing movements in the Treasury yield curve.