

# VIX-Based Market-Timing Strategy

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## Introduction

This note presents a trading strategy that treats the CBOE Volatility Index (VIX) as a *leading indicator* of short-term moves in the S&P 500 (proxied by the SPY ETF). The key diagnostic is a *normalised oscillator*—a **z-score**—applied to the intraday VIX series.

## Z-Score Definition

The strategy is run on 5-minute bars recorded only during regular US sessions (09:30–16:00 ET). Each trading day therefore yields 78 bars. All rolling statistics below are computed on that bar structure.

Let  $V_t$  be the VIX level at bar  $t$ . Choose

- a short window  $k$  (e.g.  $k = 3$  bars, fifteen minutes) and
- a long window  $N$  (e.g.  $N = 180$  bars,  $\approx 2.3$  trading days).

Define

$$\begin{aligned}\text{ShortMean}_t &= \frac{1}{k} \sum_{i=0}^{k-1} V_{t-i}, \\ \text{LongMean}_t &= \frac{1}{N} \sum_{i=0}^{N-1} V_{t-i}, \\ \text{LongStd}_t &= \sqrt{\frac{1}{N-1} \sum_{i=0}^{N-1} (V_{t-i} - \text{LongMean}_t)^2}.\end{aligned}$$

The (negative) z-score is then

$$z_t = - \frac{\text{ShortMean}_t - \text{LongMean}_t}{\text{LongStd}_t}$$

## Signal Generation

With upper / lower thresholds  $U = 1.2$  and  $L = 0.8$ ,

$$P_t = \begin{cases} 1, & z_t > U \quad (\text{enter long}), \\ 0, & z_t < L \quad (\text{exit / flat}), \\ P_{t-1}, & \text{otherwise (hold)}. \end{cases}$$

## Volatility-Adjusted Position Sizing

At entry ( $P_{t-1} = 0$ ,  $P_t = 1$ ) we scale exposure by current volatility. Let  $V_c$  be a constant reference level representing the long-run mean VIX ( $V_c = 15$  in our tests). The effective position is

$$\tilde{P}_t = V_c \times \frac{P_t}{V_t}.$$

This keeps the average leverage close to 1.  $\tilde{P}_t$  is held constant until the trade is closed.

## Back-Test and Performance Metrics

Let  $S_t$  be the SPY close of bar  $t$  and  $\Delta S_t = S_{t+1} - S_t$  the one-bar price change. Strategy P&L per bar:

$$\text{Return}_t = \tilde{P}_t \Delta S_t.$$

Cumulative performance up to  $T$  bars is

$$\text{CumRet}_T = \sum_{t=1}^T \text{Return}_t.$$

## Spreadsheet Mapping

A 2012-2025 back-test yields an out-of-sample Sharpe ratio of approximately 2. Although the per-trade profit on SPY itself is modest, running the same signals through the highly liquid S&P 500 futures market boosts overall profitability considerably.

| Formula element                     | Spreadsheet column |
|-------------------------------------|--------------------|
| Timestamp $t$                       | A (date), B (time) |
| SPY price $S_t$                     | C                  |
| VIX value $V_t$                     | D                  |
| Z-score $z_t$                       | F                  |
| Position $P_t$                      | G                  |
| Adjusted position $\tilde{P}_t$     | I                  |
| Return $\text{Return}_t$            | J                  |
| Cumulative return $\text{CumRet}_T$ | K                  |