Volume Clustering and Pivot-Based Support / Resistance Systematic Identification.

Paul de Fressenel, Quantitative Researcher Intern
Edo Theory

24th of June 2025

Introduction

Motivation

- Support and resistance are widely accepted heuristics in the technical analysis community.
- If sufficiently many market participants act on these levels, price clustering can create statistically persistent patterns.

Objective

- Our aim is to systematically detect support and resistance zones and build a trading strategy to exploit price reversals.
- Positions are initiated based on proximity to statistically significant support/resistance zones derived from volume clustering.

Approach 1: Cumulative Volume Traded

- For each trading day, we apply a rolling window of length L, partitioning the price range into N equally sized bins.
- For each bin i, we compute the exponentially weighted cumulative volume:

$$V_i = \sum_{t=t_{\text{current}}-L}^{t_{\text{current}}-1} v_{i,t} \cdot w(t)$$

where $v_{i,t}$ is the volume traded in bin i on day t.

- The exponential weight is defined as:

$$w(t) = \exp\left(-\lambda(t_{\text{current}} - t)\right), \quad \lambda = \frac{\ln 2}{h}$$

where h is the half-life.

Approach 1: Cumulative Volume Traded

- Each day, we construct a dynamic volume histogram that summarizes trading activity over the look-back window.

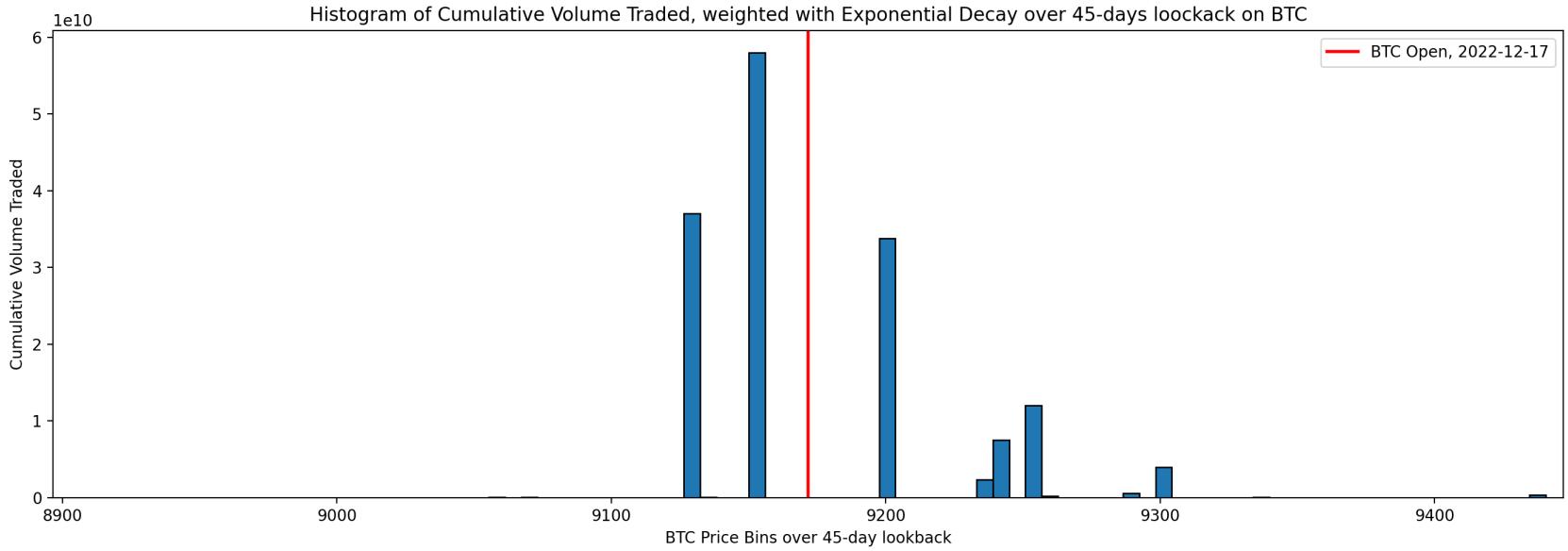


Figure 1: Rolling Histogram of Cumulative Volume Traded

- The histogram updates daily as the rolling window advances.
- High-volume clusters provide a probabilistic basis for support and resistance levels.

Support/Resistance and Signal Generation

Support and Resistance Definition

$$S_t = \text{midpoint of } \arg\max_{p_i < P_t} V_i, \quad R_t = \text{midpoint of } \arg\max_{p_i > P_t} V_i$$

Signal Function

$$\text{Signal}_t = \begin{cases} +1, & \text{if} \quad P_t \in [S_t,\ S_t(1+\beta)] \\ -1, & \text{if} \quad P_t \in [R_t(1-\beta),\ R_t] \\ 0, & \text{otherwise} \end{cases}$$

Strategy Parameters

- Key parameters used in the strategy:

Half-Life (days)	N Bins	Band Pct	Lookback (days)	Fee Rate
1	150	0.15	45	0.2%

Table 1: Parameter Configuration

- Parameters are further optimized using random search to maximize Sharpe ratio.

Approach 2: Pivot-Based Bands

- Based on intraday trading convention: prices oscillate around a central "pivot" level.
- Widely used by discretionary traders; we formalize and implement this using deterministic rules.

Formulas

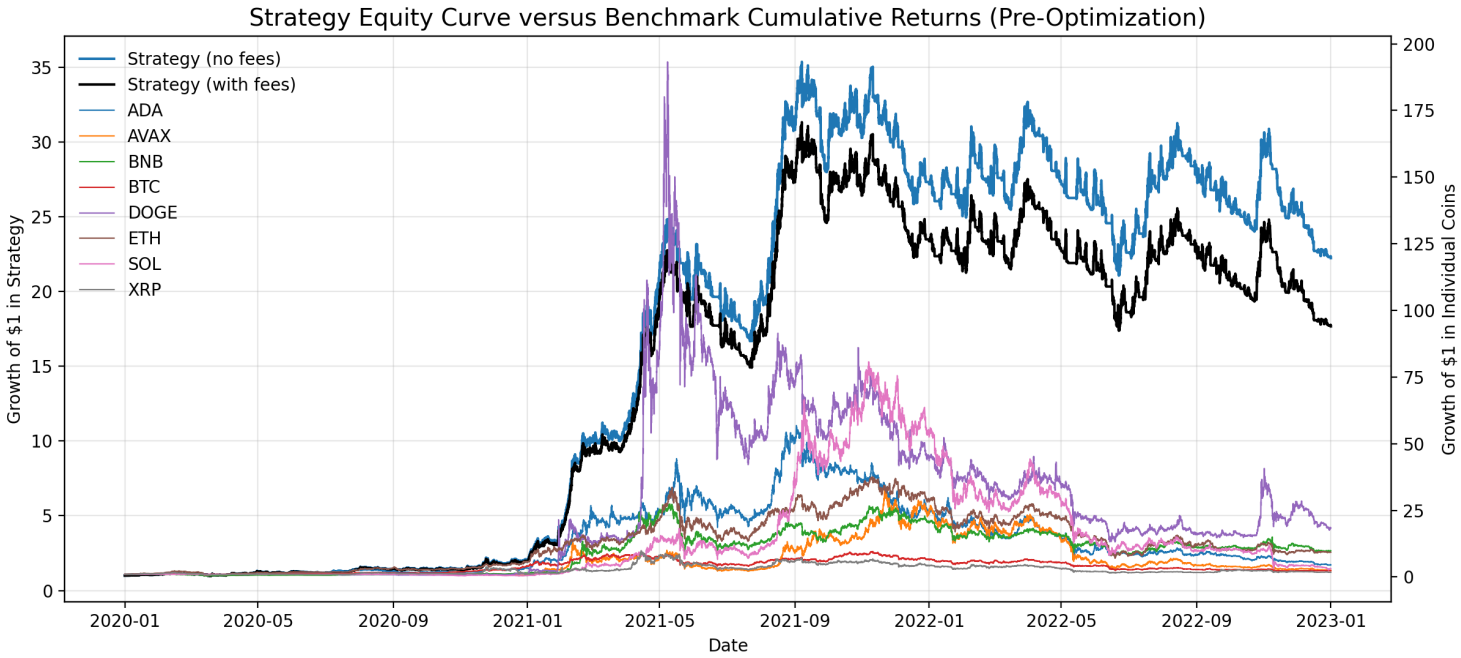
Given previous high H_{t-1}, low L_{t-1}, and close C_{t-1}:

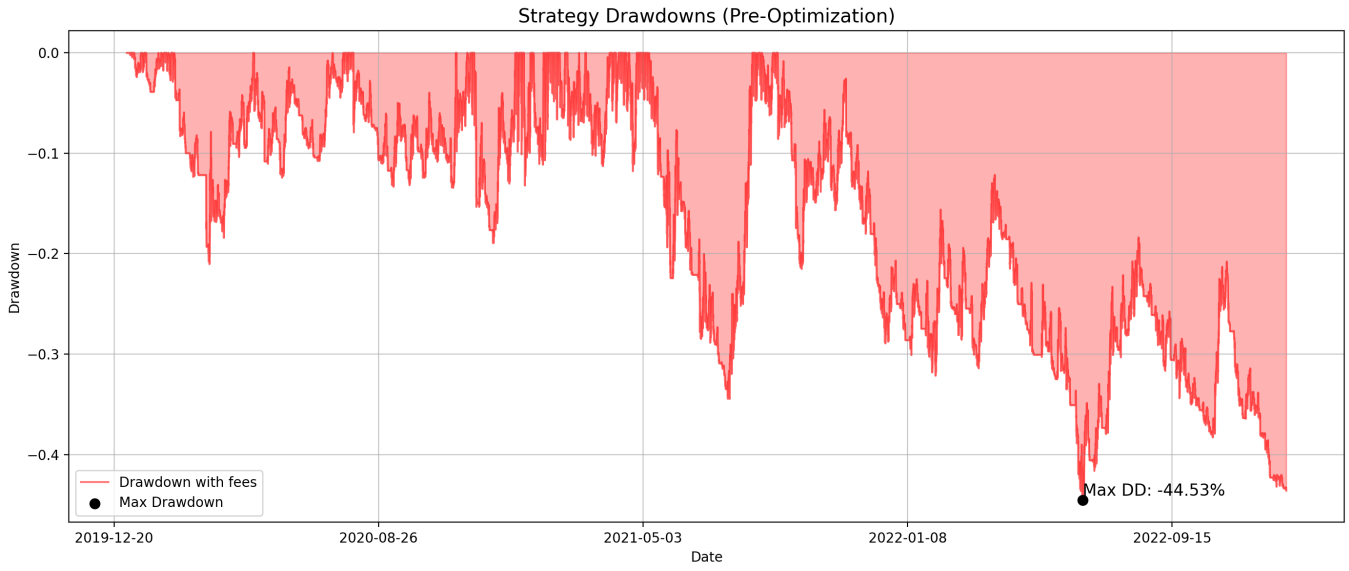
$$C_t = \frac{H_{t-1} + L_{t-1} + C_{t-1}}{3}$$

$$R_t = 2C_t - L_{t-1}$$

$$S_t = 2C_t - H_{t-1}$$

Training Set Performance (1 Jan 2020 - 31 Dec 2022)

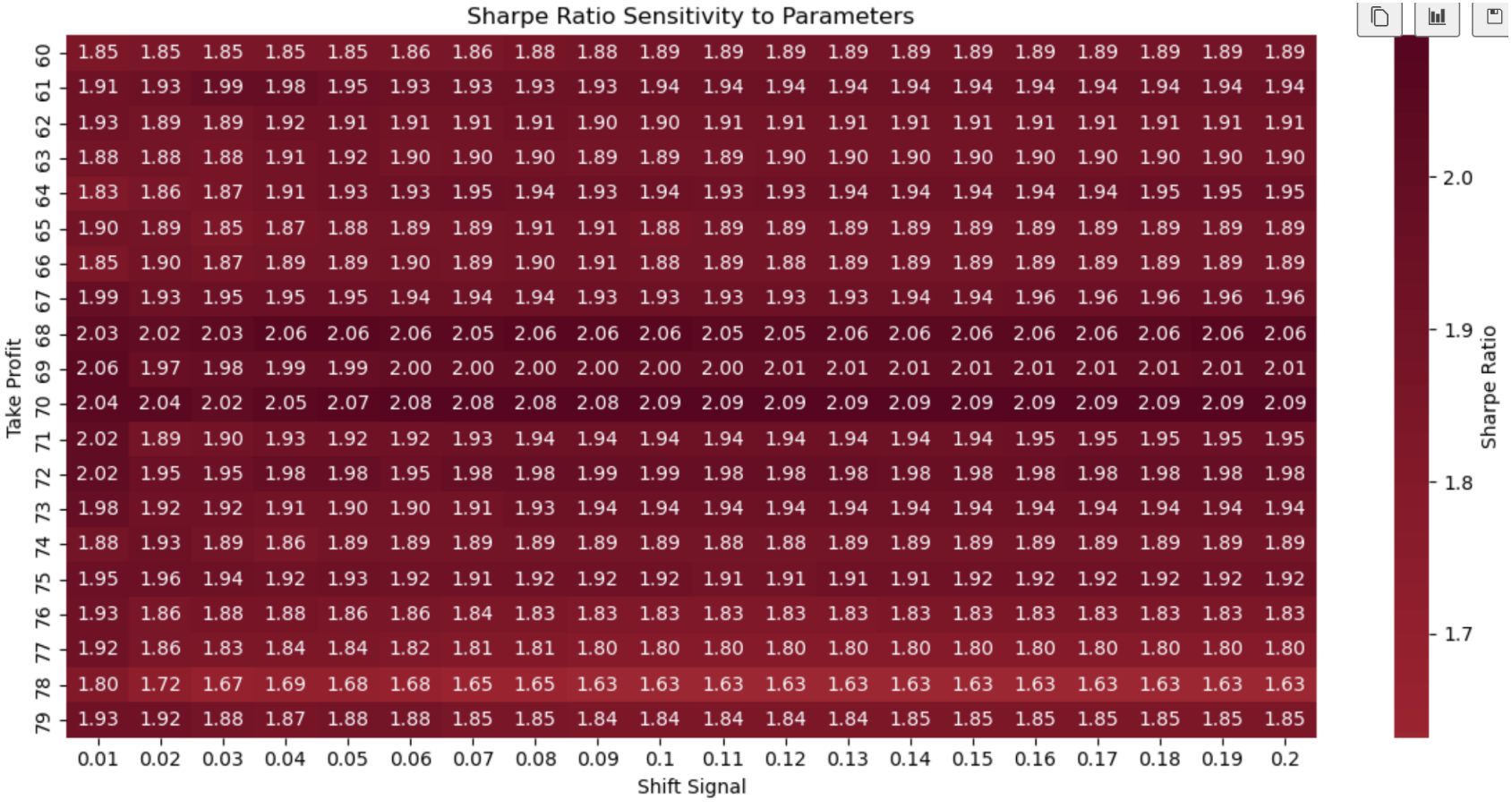




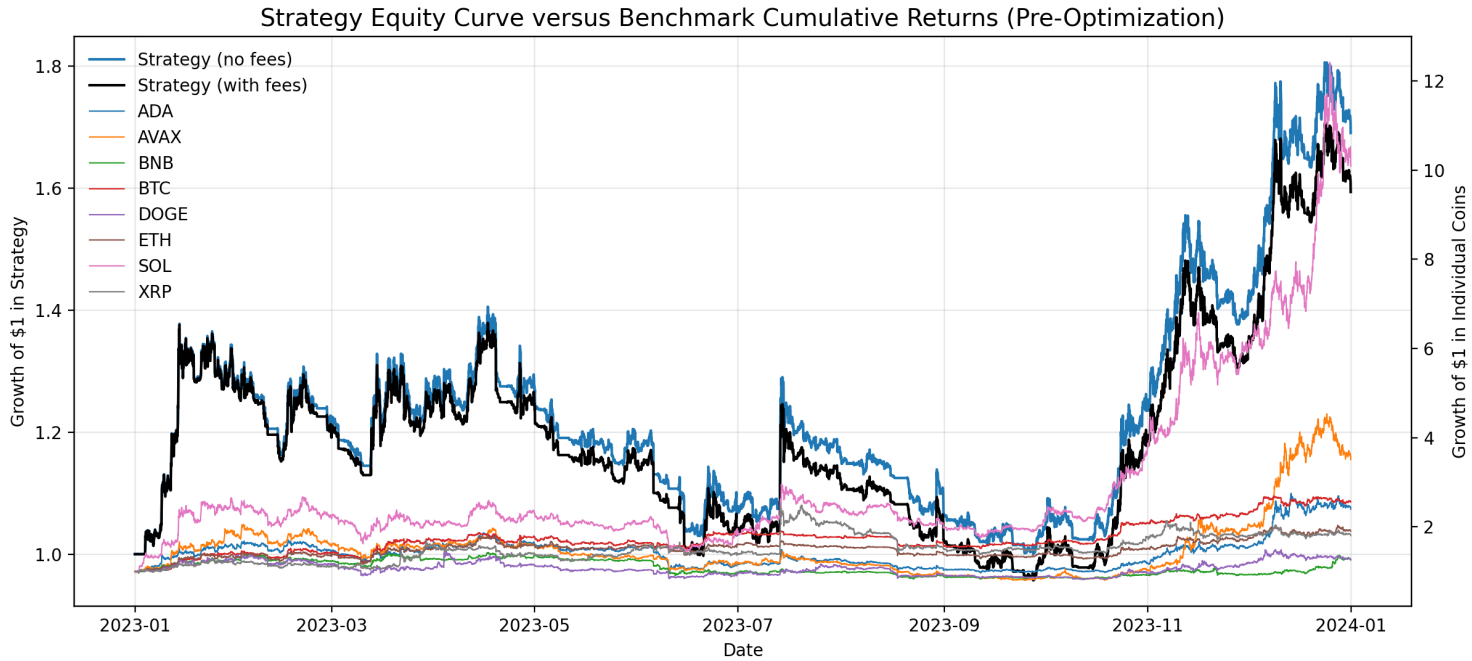
Performance Metrics

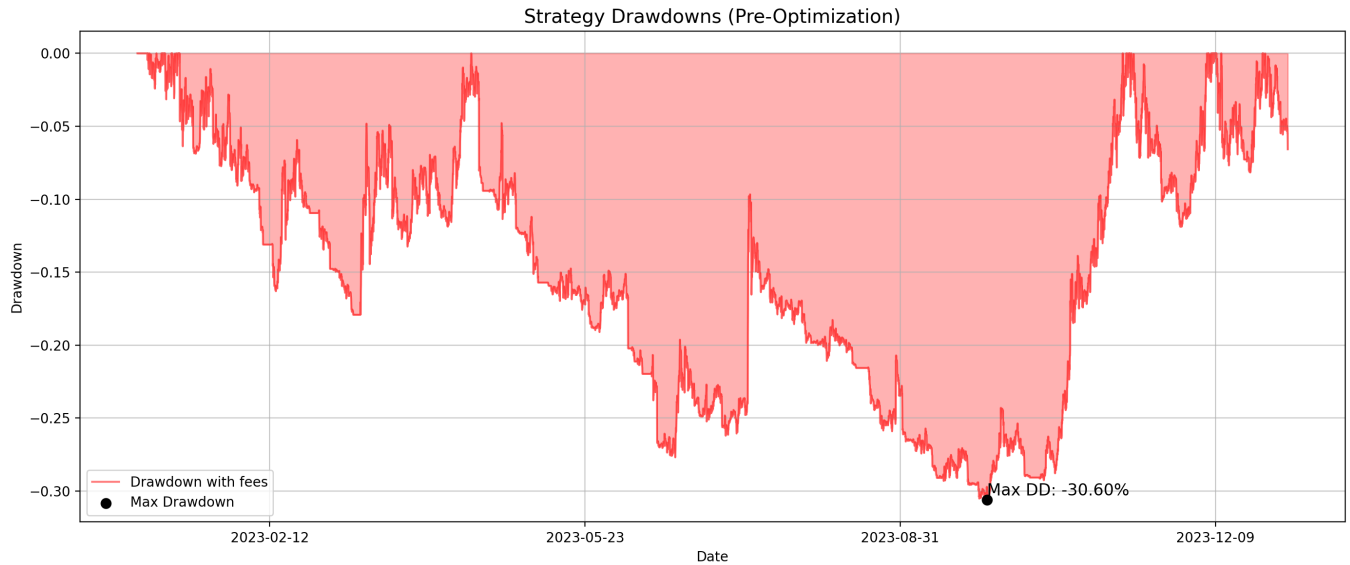
Metric	Value
Annualized Return	1.59
Annualized Volatility	0.52
Sharpe Ratio	2.06
Sortino Ratio	2.75
Maximum Drawdown	-0.44
Winning Rate	0.43
Average Holding Period	30 periods
Number of Trades	3698

Parameter Optimization: Heat Map



Validation Set Performance (1 Jan 2023 - 31 Dec 2023)





Performance Metrics

Metric	Value
Annualized Return	0.59
Annualized Volatility	0.40
Sharpe Ratio	1.34
Sortino Ratio	1.51
Maximum Drawdown	-0.30
Winning Rate	0.47
Average Holding Period	48 periods
Number of Trades	951