

Project Report: Quantitative Analysis of Trader Behavior vs. Market Sentiment

1. Executive Summary

This report investigates the correlation between the Bitcoin Fear & Greed Index and trader performance on the Hyperliquid platform using a dataset of **211,224 individual trades**. Key findings indicate that while sentiment dictates market participation levels, it is not a statistically significant independent predictor of PnL. Instead, **Total Trading Volume** emerged as the primary driver of profitability ($p < 0.001$).

2. Data Preparation & Engineering

- **Data Integration:** Merged high-frequency trade data with daily sentiment indices, resulting in **275 unique days** of synchronized data.
- **Normalization:** PnL was aggregated daily to calculate `total_pnl`, `avg_pnl`, and `total_volume`.
- **Sentiment Distribution:** The period analyzed was predominantly bullish, with **61% of days** classified as "Greed" or "Extreme Greed."

3. Key Findings & Statistical Insights

3.1 The Sentiment-Profit Paradox

An ANOVA test was conducted to determine if PnL varies significantly across sentiment categories.

- **Result:** $F=2.07$, $p=0.0844$.
- **Insight:** Since $p > 0.05$, we cannot conclude that market sentiment alone dictates profitability. This suggests that "Extreme Fear" does not automatically mean losses, nor does "Extreme Greed" guarantee gains.

3.2 Driver Analysis (OLS Regression)

A Multiple Linear Regression model was deployed to identify what actually drives `total_pnl`.

- **Total Volume (\$p < 0.001\$):** Highly significant. Profitability scales linearly with participation intensity.
- **Sentiment Code (\$p = 0.320\$):** Not significant. Trading based solely on the sentiment index without considering volume is statistically ineffective.
- **Trade Count (\$p = 0.932\$):** Not significant. High-frequency "over-trading" does not contribute to PnL as much as the size (volume) of the trades.

4. Behavioral Observations

- **Extreme Greed Peak:** The highest average PnL was observed during "Extreme Greed" phases, but these also showed the highest variance (volatility in returns).

- **Volume as Alpha:** The model explained **32.1% of PnL variance ($R^2 = 0.321$)**, indicating that while volume is a key factor, other variables like execution timing and asset selection (alpha) play a major role.

5. Strategic Recommendations

- **Volume-Weighted Execution:** Strategies should prioritize liquidity and volume signals over psychological sentiment indicators.
- **Risk Management in Greed:** Due to high PnL variance in "Extreme Greed," traders should implement tighter trailing stops as the index exceeds 75.
- **Alpha Refinement:** Since sentiment is not a direct driver, it should be used as a **volatility filter** rather than a directional signal.