Trader Behaviour and Market Sentiment Analysis: A Data-Driven Investigation

This report presents a formal analytical examination of the relationship between trader execution behaviour and market sentiment in cryptocurrency trading. The analysis leverages two key datasets—the Bitcoin Fear & Greed Index and historical Hyper liquid trader execution data—to reveal whether traders change their strategies in response to prevailing market sentiment. The study focuses on three principal behavioural dimensions: trade profitability, position sizing (risk exposure), and profits efficiency, analyse across three opinion classifications: Greed, Fear, and Neutral.

Objectives

The following objectives guide this analysis:

- **Analyze profitability patterns:** Evaluate whether trader profit-and-loss outcomes vary systematically with market sentiment conditions
- **Evaluate risk exposure dynamics:** Assess whether traders adjust position sizing (USD traded per transaction) in response to sentiment shifts
- **Identify efficiency metrics:** Measure profit generation per unit of capital deployed across different sentiment environments
- **Uncover sentiment-driven behavioural signals:** Determine whether observable trading behaviour aligns with or diverges from rational sentiment-based expectations

Datasets Description

Market Sentiment Dataset

Source: Bitcoin Fear & Greed Index (provided via Gocogle Drive)

Granularity: Daily sentiment observations spanning from February 2018 to May 2025

Key columns utilized:

- Date: Calendar date for daily alignment
- Classification: Categorical sentiment label (Fear, Extreme Fear, Greed, Extreme Greed, Neutral)
- value: Numerical sentiment index (0–100)

Data characteristics: The dataset contains 2,644 daily observations. Raw classification categories were consolidated into three operational groups for analysis: **Greed** (combining Greed and Extreme Greed classifications), **Fear** (combining Fear and Extreme Fear classifications), and **Neutral**.

Trader Execution Dataset

Source: Historical Hyper liquid trading data (provided via Google Drive)

Granularity: Individual trade execution records, totalling 211,218 transactions

Key columns utilized:

- Timestamp IST: Transaction timestamp in India Standard Time

- Size USD: Trade size in USD (position value)
- Closed PnL: Realized profit or loss per trade in USD
- Side: Trade direction (BUY or SELL)
- Account: Trader wallet address identifier
- Execution Price: Transaction price at execution

Data characteristics: The dataset spans from December 2024 to May 2025, capturing granular trade-level behaviour. Timestamps were parsed and normalized to enable daily aggregation and alignment with sentiment data.

Methodology

This section details the analytical approach used to process raw data and derive interpretable metrics.

Step 1: Timestamp Normalization and Date Extraction

Furthermore, both datasets contained timestamps in different formats. The trader execution dataset used IST timestamps, while the sentiment dataset used calendar dates. A standardized date format was extracted from trader timestamps to enable daily-level aggregation and subsequent alignment with sentiment classifications.

Step 2: Sentiment Grouping

The raw sentiment dataset contained five classification categories: Fear, Extreme Fear, Greed, Extreme Greed, and Neutral. For analytical clarity and statistical robustness, these were consolidated into three sentiment groups:

- **Greed:** Combined Greed + Extreme Greed classifications
- **Fear:** Combined Fear + Extreme Fear classifications
- **Neutral:** Standalone classification

This grouping reduces noise while preserving sentiment polarity information and maintains sufficient sample size for statistical analysis.

Step 3: Daily Aggregation of Trader Data

Individual trades were aggregated to the daily level using the extracted date field. For each date and sentiment group, the following metrics were computed:

- **Total Closed PnL:** Sum of all closed realized profit/loss across trades
- **Total Size USD:** Sum of all trade sizes in USD (absolute value, capturing trading volume)
- **Trade Count:** Number of individual transactions executed

Step 4: Data Merging and Alignment

The daily-aggregated trader data was merged with the sentiment dataset using a **left join** on the date field. This preserved all trader activity records while associating them with corresponding sentiment classifications. Records with missing sentiment data (i.e., weekend or exchange-closure dates) were retained, as trading activity does occur in cryptocurrency markets on dates without sentiment updates.

Step 5: Feature Engineering and Metric Derivation

Profit Efficiency Metric (PnL per USD): This metric quantifies profit generation per unit of capital deployed, calculated as:

$$\text{PnL per USD} = \frac{\text{Total Closed PnL}}{\text{Total Size USD}}$$

This ratio normalizes profitability by volume, allowing fair comparison across sentiment conditions where absolute trade sizes may differ. The metric reveals whether traders generate superior returns under specific sentiment conditions relative to capital deployed.

Average Trade Size (USD): Computed as the mean Size USD per day, stratified by sentiment group. This metric indicates position sizing behaviour and risk appetite.

Average Profitability: Computed as the mean Closed PnL per day within each sentiment group, reflecting absolute profit generation.

Step 6: Analytical Grouping and Visualization

Aggregated metrics were grouped by sentiment classification and summarized using descriptive statistics: mean, standard deviation (displayed as error bars), and count. Results were visualized across three dimensions to enable comparative assessment.

Analysis & Results

Profitability vs. Market Sentiment

Observed outcome: The analysis reveals a clear profitability gradient across sentiment conditions. Traders achieved a mean daily closed PnL of **$53.88 during Greed periods**, compared to **$49.21 during Fear periods** and **$34.31 during Neutral periods**. This represents a **57% difference** between peak (Greed) and trough (Neutral) profitability.

Interpretation: Traders consistently generate superior absolute returns during Greed-dominated markets. This pattern is consistent with rational market-timing behavior, where increased liquidity, trend strength, and directional conviction during greed phases support more profitable execution conditions.

Statistical spread: The standard deviation of daily PnL within each sentiment category reveals notable variability. Fear sentiment shows the highest relative volatility (standard deviation comparable to or exceeding Greed), suggesting that while mean returns are lower, individual trading days within fear phases carry greater outcome uncertainty. This increased volatility during fear may reflect forced liquidations, market dislocations, or heightened risk-aversion behaviour.

Risk Exposure vs. Market Sentiment

Observed outcome: Trade sizing (average trade size in USD) displays a reversed pattern relative to profitability. Traders execute significantly larger mean position sizes during **Fear periods** ($7,182 mean USD per trade) compared to **Greed periods** ($4,574 mean USD) and **Neutral periods** ($4,783 mean USD).

Interpretation: This counterintuitive finding suggests a **contrarian positioning strategy**. Traders systematically increase position size when market sentiment deteriorates (Fear), despite lower profitability outcomes. This behaviour is consistent with:

1. **Contrarian accumulation:** Traders buying during downturns to accumulate at lower prices
2. **Leverage deployment:** Increased capital allocation to exploit dislocations during fear-driven drawdowns

3. **Averaging down:** Adding to losing positions during decline phases

Variability consideration: Fear-phase trade sizes exhibit the highest variance (widest error bar), indicating inconsistent sizing behaviour. Some trading days during fear phases feature very large positions, while others remain smaller, suggesting selective contrarian engagement rather than systematic aggressive sizing throughout fear periods.

Profit Efficiency vs. Market Sentiment

Observed outcome: Profit efficiency (PnL per USD deployed) follows a similar gradient to absolute profitability. Traders achieve **0.0287 profit efficiency during Greed** (highest), **0.0125 during Fear** (lowest), and **0.0099 during Neutral** (lowest). Greed-phase efficiency is **2.9x superior** to Fear-phase efficiency and **2.8x superior** to Neutral-phase efficiency.

Interpretation: This metric reveals that sentiment-driven profitability differences persist even after controlling for trading volume. Traders generate substantially better returns per unit of capital deployed during Greed phases, indicating that sentiment correlates with execution quality, liquidity conditions, or directional accuracy. The divergence between volume (higher during Fear) and efficiency (lower during Fear) demonstrates that despite increasing position sizes during downturns, traders fail to achieve proportional profitability gains—a key behavioural signal.

Volatility dimension: Greed-phase efficiency carries the highest uncertainty (largest error bar), reflecting day-to-day variance in market conditions within greed phases. Fear and Neutral phases show tighter efficiency clustering, suggesting more consistent (albeit lower) execution quality.

Key Insights

The following non-obvious behavioural patterns emerge from the analysis:

1. **Inverted Risk Appetite:** Traders exhibit contrarian risk behaviour—increasing position sizes precisely when profitability declines (Fear phases). This suggests either sophisticated hedging strategies or a tendency to "double down" during downturns, with mixed outcomes. The efficiency metric demonstrates this strategy underperforms simple risk-proportional sizing.

2. **Sentiment-Profitability Asymmetry:** The 57% profitability gap between Greed and Neutral periods is not fully explained by volume differences alone. Profit efficiency metrics remain 2.8–2.9x higher during Greed, indicating that market regime changes during greed (improved liquidity, trend strength, reduced slippage) materially enhance returns independent of position sizing.

3. **Increased Uncertainty During Fear:** Fear-phase trading exhibits the highest outcome variability (widest PnL and size ranges), suggesting traders face execution challenges, greater market dislocations, or difficulty implementing consistent strategies. This elevated variance may indicate forced position management, liquidation cascades, or rapid direction reversals.

4. **Neutral Sentiment as Baseline Inefficiency:** Neutral sentiment phases yield the lowest absolute profitability ($34.31) and efficiency (0.0099 PnL/USD). This suggests that lack of strong directional conviction (neither greed nor fear) correlates with reduced trading effectiveness, possibly due to range-bound markets, reduced trend participation, or decreased confidence in position direction.

5. **Capital Deployment Misalignment:** The positive correlation between increasing position sizes during Fear and decreasing returns suggests traders systematically deploy capital sub optimally relative to market regime. Increasing size when efficiency declines represents a tactical error—position sizes should ideally scale with profitability, not inverse to it.

Challenges & Limitations

Data Coverage Constraints: The trader execution dataset spans only five months (December 2024–May 2025), a period of significant cryptocurrency market volatility. This limited timeframe restricts generalizability of findings to longer market cycles. Seasonal patterns, multi-year sentiment trends, or regime changes occurring outside this window remain unobserved.

Sentiment Classification Aggregation: The consolidation of five raw sentiment categories into three groups trades analytical granularity for statistical robustness. "Extreme Greed" and "Greed" were combined, yet may represent qualitatively different trader behavioural regimes. Sensitivity analysis across finer-grained groupings would strengthen confidence in the reported patterns.

Leverage and Liquidation Context: The provided dataset lacked explicit leverage field values and liquidation indicators. Elevated position sizing during Fear phases may reflect forced liquidation cascades or margin calls rather than deliberate contrarian strategy. Without leverage information, this distinction cannot be definitively established. The analysis treats position sizing as behavioural choice rather than accounting for exogenous liquidation pressure.

Causality Indeterminacy: This analysis reveals correlation between sentiment and trading outcomes but does not establish causality. It is unclear whether:

- Strong profitability during Greed reflects traders' superior execution in favourable market conditions, or
- Greed sentiment emerges as a lagged response to preceding price rallies where profitable traders already benefited

Time-lagged analysis or instrumental variable approaches would be required to resolve this ambiguity.

Transaction-Level Heterogeneity: The analysis aggregates across all traders and all instruments without accounting for potential account-level or coin-level heterogeneity. Some traders or instruments may exhibit distinct sentiment responses. The aggregated view masks potential subgroup interactions.

External Market Variables: The analysis lacks integration of complementary market variables—volatility (VIX-equivalent), realized price returns, funding rates, or liquidation volumes—that may confound the sentiment-behaviour relationship. Partial correlations controlling for these factors would strengthen causal inference.

Conclusion & Recommendations

Conclusion

Trader behaviour tracks market mood closely but the link shows both sensible and questionable tactics. When greed rules, traders earn markedly more (+57 % compared with neutral periods) plus squeeze 2.9 times more profit from each dollar they deploy, even though they stake smaller positions. The reason is simple - the market's plumbing works better during broad rallies - liquidity is plentiful, the trend is clear and slippage is light.

Traders enlarge their positions by half when fear dominates, just as profit per dollar slides 71 %. The tactic fails in the short term. Either they are deliberately buying ahead of a rebound that has but to arrive or they are succumbing to the urge to average down. Fear-phase trading is volatile but also erratic and execution become harder when prices gap and direction is murky.

Neutral sentiment produces the weakest results of all - returns as well as efficiency both bottoms out indicating that choppy, directionless conditions hamper every group of traders.

Recommendations

Strategic Position Sizing - Change the amount of capital you commit according to the mood of the market. When the tape shows Fear or Neutral, cut the dollar value of every new trade by 20 - 30 %. Commit the full line only after Greed has been confirmed, the period in which each dollar of risk produces its highest profit. Following this rule raises the ratio of gain to volatility.

Sentiment-Aware Execution Tactics - Build a different playbook for each mood. In Greed, ride the trend and lift every offer that appears on the tape. In Fear, abandon trend tactics - instead, quote bids and offers inside the broadened spread plus buy the reversions that appear when prices snap back from dislocation.

Hedging and Liquidation Monitoring - Watch for the chain of margin calls that occurs in Fear. If the only reason a book grows is that the exchange demands more collateral, do not treat the increase as a deliberate bet. Cut leverage as soon as sentiment slips so that the desk is never forced to sell at the worst print of the day.

Predictive Sentiment Modelling - Build indicators that turn before the crowd sours. Profit falls after mood, not before - a model that flags the shift early lets the desk lower size while prices are still high, keeps the gains earned under Greed and sidesteps the collapse that follows.

Regime-Dependent Performance Tracking - Keep one ledger for Greed, one for Neutral, one for Fear. Judge a trader by the alpha produced within each mood, not by a single headline number that mixes the trader's skill with the market's gift. Pay but also size the book according to the trader's edge in each regime.