Analysis of Trader Behavior vs Market Sentiment

Web3 Trading Team – Data Science Assignment

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1. Introduction

Financial markets are strongly influenced by collective trader psychology. In crypto markets, this psychological state is often summarized using the Fear & Greed Index, which captures whether market participants are risk-averse (fear) or risk-seeking (greed).

The objective of this analysis is to study how real trader behavior aligns or diverges from overall market sentiment, focusing on:

- Profitability

- Risk-taking behavior

- Trading volume

- Trade direction bias

By combining market sentiment data with actual historical trade execution data, this study aims to uncover behavioral patterns that can help design smarter and more disciplined trading strategies.

2. Datasets Used

2.1 Bitcoin Market Sentiment Dataset

- **Source:** Fear & Greed Index

- **Columns used:**

    o Date

    o Classification (Fear / Greed)

This dataset represents daily aggregated market sentiment.

.2 Historical Trader Data (Hyperliquid)

- **Columns used:**

    o Execution Price

- o Size Tokens

- o Size USD

- o Side

- o Timestamp IST

- o Closed PnL

Each row represents a real executed trade, capturing both position size and realized profit or loss.

3. Data Preparation & Processing

3.1 Data Cleaning

- Converted all timestamps into a standardized datetime format.

- Extracted trade dates to enable alignment with daily market sentiment.

- Converted all numeric columns (price, size, PnL) into numeric format.

- Removed rows with missing or invalid critical values.

This ensured that only valid and complete trades were used for analysis.

3.2 Feature Engineering

Since the dataset did not contain leverage information, risk was estimated using USD exposure, which is a realistic proxy in trading environments.

The following features were created:

- **Trade Volume:** Absolute USD exposure of each trade

- **Profitability Flag:** Whether a trade resulted in profit

- **Direction:** Long (Buy) or Short (Sell)

- **Risk-Adjusted Return:**

$$\text{Risk-Adjusted Return} = \frac{\text{Closed PnL}}{\text{Trade Volume}}$$

3.3 Data Integration

The trader dataset was merged with the Fear & Greed dataset using the trade date.
This allowed each trade to be analyzed in the context of prevailing market sentiment.

4. Exploratory Data Analysis & Results

4.1 Profitability vs Market Sentiment

Key observations:

- Average and median PnL during Fear periods were generally more stable.

- Greed periods showed higher variance in PnL, indicating increased volatility.

- Win rates during fear were comparable or slightly higher than during greed.

Interpretation:
During fearful markets, traders appear more selective and disciplined, whereas greed periods encourage aggressive participation, increasing volatility and downside risk.

4.2 Trading Volume Behavior

- Total trading volume was significantly higher during Greed periods.

- Fear periods showed lower participation but more controlled exposure sizes.

Interpretation:
Greed sentiment encourages overtrading and larger capital deployment, while fear leads to reduced participation and risk aversion.

4.3 Directional Bias (Long vs Short)

- Greed periods showed a higher concentration of long positions.

- Fear periods displayed a more balanced or defensive trade direction distribution.

Interpretation:
Traders tend to chase upward momentum during greed, while fear introduces hesitation and defensive positioning.

4.4 Risk-Adjusted Performance

- Risk-adjusted returns were higher during Fear periods.

- Greed periods exhibited lower efficiency per unit of risk taken.

Interpretation:
Although greed periods attract more capital, they do not necessarily reward traders proportionally, suggesting diminishing returns due to overcrowding and emotional trading.

5. Key Insights

1. **Fear markets reward discipline**
   Traders tend to achieve better risk-adjusted returns during fear, despite lower trading volumes.

2. **Greed increases exposure but not efficiency**
   Higher volumes and aggressive positioning during greed do not consistently translate to superior profitability.

3. **Market sentiment strongly influences behavior**
   Directional bias, trade sizing, and participation levels all shift noticeably with sentiment changes.

6. Trading & Strategy Implications

Based on the analysis:

- Traders should reduce position sizes during greed to avoid overexposure.

- Risk-adjusted metrics should be prioritized over raw PnL during high-sentiment phases.

- Fear periods may present higher-quality opportunities for disciplined, selective strategies.

- Automated trading systems can incorporate sentiment-based risk scaling to improve long-term performance.

7. Limitations & Assumptions

- Leverage data was not available; USD exposure was used as a proxy for risk.

- Sentiment was analyzed at a daily level; intraday sentiment fluctuations were not captured.

- Results reflect historical behavior and may not generalize to all market regimes.

8. Conclusion

This study demonstrates that market sentiment has a measurable and meaningful impact on trader behavior. While greed attracts capital and volume, fear often produces more efficient and disciplined outcomes. Integrating sentiment awareness into trading strategies can help improve decision-making, risk management, and long-term performance in volatile crypto markets.

9. Note

Due to GitHub file size limitations, large intermediate CSV files are not stored in the repository. All datasets are generated reproducibly via theGoogle Colab notebook.