

# Data Science Report

## Analyzing Trader Behavior vs Market Sentiment

### Primetrade.ai Internship Assignment

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#### □ Objective

To analyze how trading behavior (profitability, risk, volume, leverage) aligns or diverges from overall market sentiment (Fear vs Greed), and identify hidden patterns that can drive smarter trading strategies.

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#### □ Introduction

Understanding how trader behavior shifts under different market sentiments is critical to designing intelligent trading systems. This project, assigned as part of the internship assessment with Primetrade.ai, aimed to analyze trade-level performance across emotional market regimes — specifically Fear, Greed, and Neutral — using historical execution data combined with the Fear & Greed Index.

The goal was to evaluate how key trading metrics such as profitability (PnL, ROI), risk (Sharpe Ratio, volatility), and capital exposure (trade volume, size) align or diverge depending on sentiment. As an aspiring data scientist, I approached this analysis with curiosity and a structured approach, focusing on building reusable code, insightful visuals, and extracting data-driven signals that can inform smarter trading strategies.

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#### □ Methodology

##### 1. Data Preparation:

- Merged trader execution data with sentiment classifications.
- Converted timestamps to daily resolution and aligned formats.
- Cleaned data by removing irrelevant columns (e.g., hashes, order IDs).
- The dataset consisted of **32 unique trader accounts**, each with multiple trade entries across varying market sentiment regimes.

##### 2. Feature Engineering:

- Calculated ROI = (Closed PnL / Size USD) \* 100.
- Flagged profitable trades for win rate computation.
- Estimated Sharpe Ratio = mean ROI / std deviation of ROI per sentiment class.

##### 3. Visualization Tools:

- Libraries used: Pandas, Matplotlib, Seaborn.

- Plotted boxplots, bar charts, scatterplots, pie charts, and sentiment trends.
4. **Sentiment Classification:**
- Used categories: Fear, Greed, Neutral (based on index value).
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## □ Visual Analysis & Findings

### 1. *Sentiment Trend Over Time*

- The Fear & Greed Index fluctuates sharply.
- Peaks in greed often precede periods of high trading volume.
- Bottoms in fear signal volatility zones.

### 2. *Trade Distribution by Sentiment*

- Over 70% of trades and 80% of volume occur during **Fear**.
- **Greed** comprises ~23% of trades and ~18% of volume.
- **Neutral** is rarely traded, possibly due to unclear direction.

### 3. *PnL Distribution by Sentiment*

- **Fear**: Highest volatility (wider spread, more outliers).
- **Greed**: More consistent PnL with fewer extreme losses.
- **Neutral**: Low variability and low returns.

### 4. *Performance Metrics by Sentiment*

- **Greed** shows the highest Sharpe Ratio (0.31) and ROI (~5.41%).
- **Fear** has the most trades but the lowest Sharpe (~0.01), indicating riskier, inconsistent performance.
- **Neutral** trades show the weakest performance across all metrics.

### 5. *Top Traders by Sentiment*

- Trader performance is sentiment-dependent.
  - Out of the 32 trader accounts analyzed, only a small subset consistently performed well under specific sentiment conditions.
  - This supports the hypothesis that trading behavior and profitability are highly sentiment-dependent.
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## □ Insights & Recommendations

### 1. **Greed is Optimal for Strategy Execution:**

- Traders are more profitable and consistent.
- Strategies like trend-following or momentum trading are likely effective.

### 2. **Fear Brings Risk and Opportunity:**

- High dispersion in outcomes — some succeed massively, others fail.
- Use tighter risk controls and potentially deploy volatility-based strategies.

### 3. Neutral Sentiment = Low Yield Zone:

- Traders underperform during indecisive market phases.
- Could be ideal for low-risk or non-directional strategies.

### 4. Position Sizing Should Be Sentiment-Aware:

- Larger trades during Fear lead to volatile outcomes.
- In Greed, larger trades tend to yield better consistency.

### 5. Leverage and Fee Optimization:

- Higher fees are seen during Fear, possibly due to higher volume and urgency.
  - Strategies could factor in optimal fee vs gain trade-off.
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## □ Strategic Implication

Market sentiment isn't just emotional noise — it's a quantifiable factor that influences how and when to trade. By aligning trading style and risk exposure with sentiment classes, traders (and bots) can potentially improve outcomes significantly.

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## □ Files & Outputs

- `cleaned_trades.csv`: Final processed dataset
  - `notebook_1.ipynb`: Full code and data pipeline
  - `outputs/`: All visuals used in this report (PNL, sentiment, traders, etc.)
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## □□ Final Thoughts

This project gave me a deeper appreciation for how data can quantify market psychology and behavior. By analyzing real trade outcomes across sentiment conditions, I learned to connect statistical patterns with strategic decisions. It also strengthened my skills in exploratory data analysis, feature engineering, and communicating insights effectively. I'm excited to keep learning and applying data science to real-world problems through hands-on, impact-driven work like this.