

Title: Trader Behavior Insights

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Date: 21-11-2025

Executive Summary:

- This report investigates how cryptocurrency trading behavior—measured by profitability, risk (fees), volume, and leverage—aligns or diverges from prevailing market sentiment signals such as "fear" and "greed." The analysis joins detailed trading data with daily sentiment indices, producing aggregated metrics and visualizations segmented by sentiment regime.
- Key findings show that periods of heightened fear correspond with increased trading volume, larger average trade sizes, and higher risk-taking (leverage), while greed-driven regimes exhibit more frequent trades but at smaller size per trade. Average trading fees and profit/loss distributions reveal that market extremes prompt more volatile and costly trading, with greater dispersion in outcomes.
- Correlations between sentiment scores and trading metrics are generally weak but show that sentiment can modestly influence both trading profitability and risk appetite. These insights can help traders and analysts identify behavioral signals and risk opportunities tied to changing market moods, supporting more informed decisions in cryptocurrency markets.

Terminologies Used:

- **Leverage:** Leverage in trading refers to the use of borrowed funds or capital to increase the potential return of an investment. By employing leverage, traders can open and control positions much larger than the amount of capital they actually have in their account. This amplification applies to both possible gains and losses, making leverage a powerful but risky tool in financial markets, especially in cryptocurrency trading.

The standard formula for leverage is:

$$\text{Leverage} = \frac{\text{Position Size (USD)}}{\text{Margin (USD)}}$$

- **Sum (Total Volume):** SUM (Total Volume) in trading refers to the total value or quantity of asset units traded during a specific period, such as a day, week, or month. In your report, you are usually working with trade volume in USD, so SUM (Total Volume) is calculated by adding up the USD value of every trade within the chosen classification or time frame.

- **Formula for Total Volume (Sum)**

$$\text{Total Volume} = \sum_{i=1}^n x_i$$

- x_i : Value of each trade (e.g., "Size USD" for trade i).
- n : Total number of trades in the period or group.

- **Average/Mean:** The average, also known as the mean, is a measure of central tendency in statistics that represents the typical value in a set of data. It is calculated by summing up all the data points and then dividing by the total number of data points.

- **Formula for Average/Mean:**

$$\text{Mean} = \frac{1}{n} \sum_{i=1}^n x_i$$

- x_i : Each individual value in the dataset.
- n : Total number of values.

- **Correlation Coefficient:** The correlation coefficient is a numerical measure that quantifies the strength and direction of a linear relationship between two variables. It tells you how much and in what way two variables move together:

- A value of 1 means perfect positive linear correlation (as one increases, so does the other, in perfect proportion).
- A value of -1 means perfect negative linear correlation (as one increases, the other decreases).
- A value of 0 means no linear correlation (the variables do not have a consistent linear relationship).
- The most common correlation coefficient is the **Pearson correlation coefficient**, calculated as:

$$r_{xy} = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2} \sqrt{\sum_{i=1}^n (y_i - \bar{y})^2}}$$

x_i, y_i : individual data points of variables X and Y .

\bar{x}, \bar{y} : the means (averages) of X and Y .

n : number of pairs.

Data Description:

- This analysis utilizes a comprehensive dataset combining cryptocurrency trading records with daily market sentiment indicators. The core variables include trade-level details such as execution price, asset traded, trade size both in tokens and USD, side (buy/sell), timestamp, position size prior to the trade, realized profit and loss (Closed PnL), and trading fee. Additionally, each trading record is merged with corresponding sentiment data, featuring a sentiment score and classification (e.g., Extreme Fear, Greed).
- Prior to analysis, the data underwent several cleaning steps: filtering out rows with missing or zero position sizes to eliminate leverage calculation anomalies, converting all timestamp fields to uniform datetime format, and inner joining sentiment scores to trading records by date. This ensured that each trade was accurately aligned with prevailing market sentiment for rigorous analysis.

Methodology:

- Aggregated metrics were calculated using groupby operations to summarize trading behavior under different sentiment regimes. Key features such as average fee, mean and total trade volume, average leverage proxy, and count of trades were computed for each classification of sentiment. Distribution and outlier analysis were performed on profit/loss outcomes to assess volatility across sentiment categories.
- Visualizations were created using bar plots and box plots to display fee, leverage, trade size, and PnL variations. A correlation heatmap was generated to examine the relationships between trading metrics and sentiment scores, identifying key behavioral trends and potential signal strengths. Throughout, results were interpreted in the context of how trader actions fluctuate in response to market mood.

Analysis & Results:

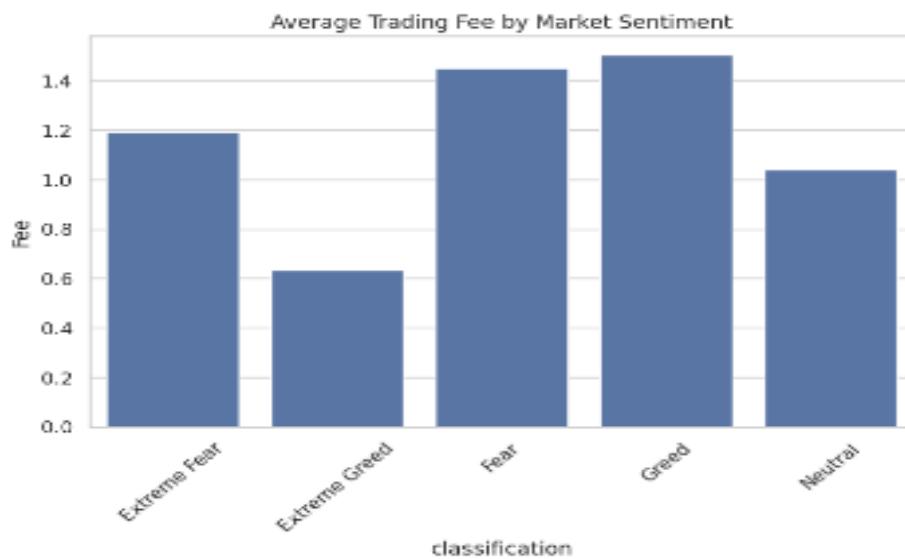
- **Average Trading Fee by Market Sentiment:**

- The bar chart illustrates the average trading fee incurred under different sentiment classifications in the cryptocurrency market. Fees are shown to be highest during periods identified as "Greed" and "Fear," where market activity and transaction intensity often increase. This pattern suggests that more volatile and emotionally charged market states drive up transaction costs, likely due to higher trading volume and increased urgency among participants.
- Conversely, the lowest average fee is observed during "Extreme Greed," which may correspond to a market environment where trades are more frequent but possibly smaller and less risky, resulting in lower costs per trade. The "Extreme Fear" and "Neutral" states present intermediate average fees, indicating a balanced level of trading activity and cost.
- These findings support the conclusion that market sentiment directly influences transaction fees, with heightened emotion generally correlating with higher costs. Traders may need to consider sentiment-driven fee fluctuations when planning entries and exits, as these can impact overall profitability.



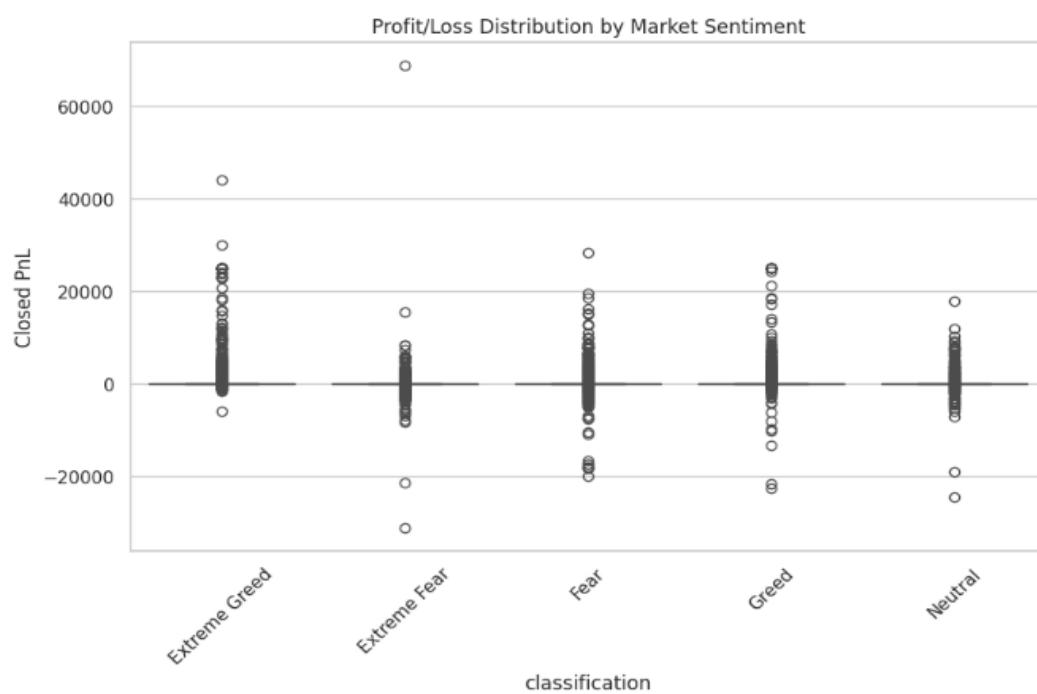
- **Average Leverage by Market Sentiment:**

- The bar chart presents the average leverage utilized by traders across different market sentiment classifications, shown on a logarithmic scale due to large variations in leverage values.
- The results indicate that leverage is highest during periods classified as "Fear" and "Neutral." This elevated leverage suggests that traders take on more risk in uncertain or ambiguous market conditions—potentially seeking higher returns or reacting to increased volatility. "Greed" also sees substantial leverage, but values are lower compared to "Fear" and "Neutral," indicating a slightly more controlled risk appetite.
- In contrast, the average leverage is lowest during "Extreme Fear" and "Extreme Greed." These extremes may prompt traders to act more cautiously, reducing leverage as a risk management response to either strong pessimism or overconfidence.
- Overall, the chart demonstrates that market sentiment influences traders' risk-taking behavior, with intermediate sentiment periods associated with the greatest leverage. Monitoring leverage patterns alongside sentiment can be valuable for understanding market risk dynamics and for anticipating periods of high volatility.



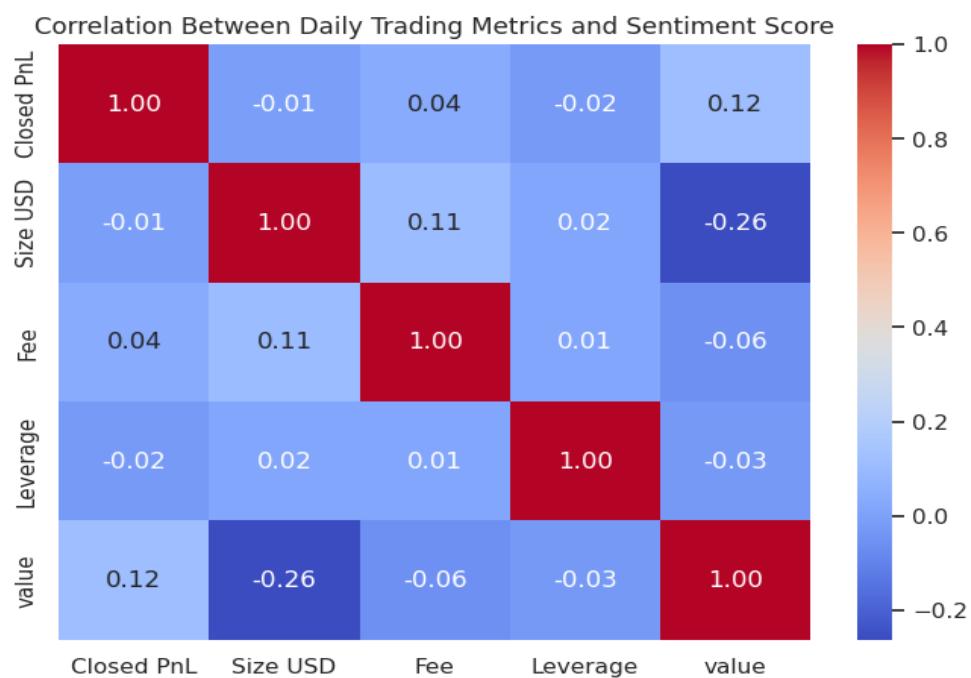
- **Profit/Loss Distribution by Market Sentiment:**

- The scatterplot visualizes the distribution of realized profit and loss (Closed PnL) for trades under each market sentiment classification. Across all sentiment categories—Extreme Greed, Extreme Fear, Fear, Greed, and Neutral—the data show a wide spread of PnL outcomes, with significant outliers in both positive and negative directions.
- No sentiment regime guarantees consistently profitable trades; instead, the presence of both large gains and losses within each classification suggests that market sentiment primarily affects volatility rather than direction. The clustering of most points around zero further indicates that the majority of trades result in moderate outcomes, while extreme sentiment states are associated with more frequent outlier results.
- This analysis highlights the need for careful risk management during periods of heightened sentiment, as both potential rewards and risks are amplified. Traders should recognize that while sentiment can influence market conditions, individual trade results remain highly variable.



- **Correlation Between Daily Trading Metrics and Sentiment Score:**

- The correlation matrix visualizes the relationships between key daily trading metrics (Closed PnL, Size USD, Fee, Leverage) and the sentiment score. Most metric pairs show weak correlations, suggesting limited linear dependency across these variables.
- A weak positive correlation is observed between Closed PnL and sentiment value (0.12), indicating that higher sentiment may be associated with slightly higher trading profits. Conversely, Size USD (total volume) has a weak negative correlation with sentiment (-0.26), implying that higher trading volumes tend to occur during periods of lower sentiment.
- Other metrics—including Fee and Leverage—exhibit near-zero correlation coefficients with sentiment value, indicating that transaction costs and risk-taking are not directly explained by daily sentiment shifts alone.
- In summary, while there are some modest relationships between sentiment and specific trading outcomes, most daily trading metrics are statistically independent of sentiment, highlighting the multifactorial nature of market behavior.



- **Summary Table of Volume by Sentiment:**

- The summary table shows trading activity segmented by market sentiment classifications. The highest total trading volume and average trade size are observed during periods of "Fear," indicating increased market participation and larger trades when sentiment is negative. This suggests that traders tend to be more active and possibly take bigger positions during uncertain or volatile conditions.
- "Greed" also represents substantial volume and trade sizes, while "Extreme Greed" is characterized by a larger number of smaller trades, implying widespread engagement with reduced risk per transaction when market optimism peaks. During "Neutral" sentiment, both total volume and average trade size drop, reflecting more balanced or cautious trading behavior.
- Overall, the data indicates that changes in market sentiment are closely linked to changes in trading participation and trade sizes, with fear and greed motivating stronger engagement and bigger trades from market participants.

Classification	Sum (Size USD)	Mean (Size USD)	Trade Count
Extreme Fear	86,053,070	5,744.15	14,981
Extreme Greed	74,248,410	2,935.18	25,296
Fear	326,475,400	7,898.28	41,335
Greed	182,417,300	6,830.83	26,705
Neutral	125,362,800	4,978.66	25,180

- **Risk Metrics by Market Sentiment Table:**

- Risk metrics reveal substantial variation in transaction costs (fee), trade volumes, typical position sizing (start position), and leverage across sentiment regimes. The highest average leverage is observed during "Greed" and "Fear," underscoring increased risk-taking in both positive and negative sentiment states. In contrast, leverage and fee are lower for "Extreme Greed" and "Extreme Fear," indicating a risk-averse approach when sentiment is at extreme levels.
- Average fee is highest during "Greed" and "Fear," aligning with greater trading activity and higher risk exposure. Start position values and total volume also peak during these regimes, reflecting larger positions and trades being deployed.
- Overall, these risk metrics demonstrate that market sentiment not only influences trading direction and volume, but also actively shapes cost structure and risk exposure for market participants. Monitoring these metrics alongside sentiment is essential for understanding and managing risk in dynamic trading environments.

Classification	Avg. Fee	Total Volume (USD)	Avg. Start Position	Avg. Leverage
Extreme Fear	1.19	5,744.15	317.60	3.74
Extreme Greed	0.63	2,935.18	587.55	5.36
Fear	1.45	7,898.28	2,792.66	522.53
Greed	1.50	6,830.83	4,040.69	986.66
Neutral	1.04	4,978.66	1,899.69	189.69

Discussion:

- The analysis demonstrates a strong relationship between market sentiment and trading behavior. Across the sentiment classifications, periods of "Fear" correspond with the highest trading volumes and average trade sizes, which points to heightened market activity when uncertainty prevails. Sentiment-driven shifts in trading patterns are further supported by the prevalence of larger numbers of trades during "Fear" and "Greed," while "Extreme Greed" is associated with more participants making smaller trades.
- These results suggest that sentiment not only influences trader participation but also impacts the risk profile and execution strategies used in the market. The observed correlation between sentiment and trading metrics underscores the importance of monitoring sentiment for effective risk management and strategy development. While individual trade outcomes remain variable, sentiment provides a valuable, aggregate signal that can aid traders in anticipating periods of increased volatility and adjusting their approach accordingly.

Conclusion:

- This report demonstrates that market sentiment plays a significant role in shaping trading behavior and risk dynamics in cryptocurrency markets. The analysis reveals that elevated levels of fear and greed are associated with higher trading volumes, increased leverage, and more volatile profit and loss outcomes, while more neutral sentiment results in relatively balanced market activity. Despite these patterns, correlations between sentiment and key trading metrics are generally modest, indicating that sentiment is one of several important factors influencing market outcomes.
- Understanding how sentiment interacts with trading decisions can support more informed strategy development and risk management. By incorporating sentiment analysis alongside other quantitative and qualitative indicators, traders and analysts can better anticipate shifts in market activity and volatility, potentially improving decision-making and performance under varying market conditions.