

Investment Strategy Research in the New Energy Vehicle Industry Based on Google Trends: A Case Study of Tesla

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Abstract. This paper investigates a sentiment-based trading strategy in the context of the new energy vehicle industry, using Tesla (TSLA) as a representative case. Using Google Trends search volume data as a tool to observe public attention, we construct a simple momentum-style signal to evaluate the effectiveness of market sentiment in guiding trading decisions. The study compares the performance of the sentiment strategy with a traditional buy-and-hold strategy across four market regimes, including two bull markets and two bear markets. Our results suggest that the sentiment-based strategy significantly outperformed in bear markets, but counterintuitively underperformed in bull markets. This indicates that Google Trends data may serve as a useful complementary indicator in volatile or downward-trending environments. The paper contributes to the literature by extending sentiment momentum research from cryptocurrencies and broad indices to a major individual stock in the clean tech sector, Tesla, which is also a highly sentiment-driven stock.

1 Introduction

One of the most important sectors in the global shift to low-carbon economies is the new energy vehicle (NEV) sector. Over the past ten years, the NEV market has grown exponentially because to rising environmental consciousness, government incentives, and quick advancements in battery technology. Among the businesses spearheading this change, Tesla Inc. (TSLA) is by far the most significant and remarkable participant. Beyond its leadership in the development and manufacturing of electric vehicles, TSLA has drawn a lot of interest from the media, capital markets, and online communities, establishing itself as a financial phenomenon in addition to a technological icon[1].

Due in part to its visionary leadership, speculative investor behavior, and regular media exposure, Tesla's stock shows abnormally high volatility. Because of these characteristics, TSLA is a perfect topic for researching the connection between changes in asset prices and investor mood. TSLA frequently responds strongly to changes in public attitude, news events, and internet debates, which suggests a higher sentiment component in its pricing dynamics than traditional fundamental-driven stocks[2]. Therefore, comprehending and measuring this

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attitude could provide information about behavioral finance mechanisms and short-term trading opportunities.

Scholars and investors have been looking for various ways to understand investor sentiment, such as search engine data, social media activity, and the tone of financial news. Among those, Google Trends has become a useful tool providing time-series data on the popularity of search terms. Numerous studies have validated its predictive power in cryptocurrency markets and broad market indices. However, its application to individual high-volatility stocks like TSLA remains limited and unexplored.

This paper seeks to bridge that gap by investigating whether Google search interest in “Tesla” can be used to construct a sentiment-based momentum indicator. Specifically, we examine whether changes in TSLA-related Google search volume can forecast short-term price movements. The central hypothesis is that a rising trend in search volume reflects increasing investor attention and optimism, which may precede positive price momentum. We propose a simple strategy: take long positions in TSLA when current search volume exceeds its recent moving average, and stay in cash otherwise.

To evaluate the performance of this sentiment-driven strategy, we construct a backtesting framework over four distinct 90-day trading windows, each representing a different market regime: two bull markets (April-August 2020 and October 2023-March 2024) and two bear market phases (April-August 2022 and November 2022-March 2023). For each period, we compare the cumulative returns of the sentiment strategy with those of a traditional buy-and-hold approach, using multiple holding intervals and moving average parameters.

This study contributes to the literature in two main ways. First, it extends the application of Google Trends-based sentiment analysis from macro-level assets (e.g., indices, BTC) to a major individual equity. Second, it provides empirical evidence on how sentiment signals perform differently under varying market conditions. Practically, our findings may offer retail and quantitative investors a lightweight yet effective tool for enhancing timing decisions—particularly during volatile or uncertain periods.

2 literature review

Investor sentiment has long been recognized as a key driver of short-term asset price fluctuations. In recent years, the rise of behavioral finance has motivated scholars to explore various proxies for measuring sentiment. One widely adopted tool is Google Trends, which captures the relative frequency of specific search terms over time. Preis et al. were among the first to demonstrate that increased search volume on financial terms can predict future stock market movements. Investors could use this method to improve their strategy return [3].

The predictive power of Google Trends has also been validated in the cryptocurrency space. Kristoufek found that Bitcoin prices are significantly influenced by online search interest, and that price movements often follow increases in public attention [4]. Similarly, Wei conducted an empirical analysis using Google Trends to design a trading strategy for Bitcoin [5]. The study found that when the current search volume exceeds its recent average, the signal can generate excess returns over a buy-and-hold benchmark, especially when optimized holding and lookback parameters are applied. This provides further evidence that search-based sentiment indicators can be effective in volatile markets such as cryptocurrency.

In the context of traditional financial markets, Bollen et al. employed Twitter sentiment analysis to forecast the Dow Jones Industrial Average, while Antweiler and Frank examined how online message board activity affects stock volatility and trading volume [6,7]. These studies highlight the growing academic consensus that sentiment extracted from digital platforms has practical implications for market prediction. These implications enable

investors to have more methods and strategies to enhance their profitability and hedge the risks.

In addition to cryptocurrencies and equity indices, sentiment-based trading strategies have gradually been explored across a variety of asset classes. While earlier studies focused on Bitcoin and major indices, recent works have begun testing similar sentiment signals on exchange-traded funds, commodity futures, and sectoral portfolios. Though results vary across markets, this growing line of research demonstrates the broad applicability of search-driven and attention-based indicators in algorithmic trading contexts.

Despite this growing body of work, there remains a notable gap in the application of sentiment-based strategies to individual high-volatility stocks such as Tesla. Most prior studies focus either on market-level indices or highly speculative assets like Bitcoin. TSLA, as a widely-followed stock with significant media presence and emotional investor base, opens a window to explore the relationship between public attention and stock performance at the firm level. This study aims to fill that gap by evaluating whether a Google Trends-based sentiment signal can improve trading outcomes when applied specifically to TSLA.

3 Theoretical framework and hypothesis

This study is grounded in two theoretical perspectives: the investor attention hypothesis and the sentiment momentum theory. The investor attention hypothesis suggests that changes in asset prices are partially driven by shifts in public attention, especially when investors respond to salient events or news coverage. In high-volatility stocks like Tesla (TSLA), whose performance is closely tied to public perception, attention-based signals may significantly influence short-term market movements.

In addition, sentiment momentum theory posits that periods of elevated optimism or pessimism—often measured through online activity—can lead to continuation in price trends, due to delayed investor reactions or herd behavior. Prior studies have shown that online search trends often precede market moves, suggesting that search volume data can serve as a proxy for investor sentiment.

Based on this theoretical foundation, we construct a sentiment indicator defined as the difference between current Google Trends search value and its moving average over the past m days. A positive value indicates above-average attention, which we interpret as a bullish sentiment signal. Our hypothesis is as follows

Hypothesis: When the sentiment indicator is positive, TSLA stock generates excess returns relative to a passive buy-and-hold benchmark.

We empirically test this hypothesis by applying it to four different market environments and comparing the outcomes with those of a benchmark strategy.

4 Data and methodology

This study uses two primary data sources. The daily closing prices of Tesla Inc. (TSLA) are collected from Investing.com. This dataset provides 90 trading days of historical price information. The second dataset consists of daily search interest data for the keyword “Tesla” retrieved from Google Trends (<https://trends.google.com/>), which measures the relative popularity of the search term on a scale of 0 to 100. The value 100 corresponds to peak search interest during the selected time range, while lower values reflect proportionally less interest.

To quantify investor sentiment, we construct a simple momentum-style indicator using the Google Trends data. Specifically, the sentiment signal on day t , denoted as tm , is defined as:

$$tm = GT(t) - (1/m) \times \Sigma [GT(t-i)], \text{ where } i = 1 \text{ to } m \quad (1)$$

In this formula, $GT(t)$ represents the Google Trends score on day t , and m is the length of the sentiment averaging window. The term $\Sigma [GT(t-i)]$ is the sum of search interest over the previous m days. A positive t_m value suggests that investor attention has recently increased relative to the past average, which may indicate growing optimism in the market.

Based on this sentiment signal, we implement a rule-based trading strategy. The strategy initiates a long position in TSLA if the sentiment signal t_m is positive on a given day. If the sentiment signal is zero or negative, the position is exited, and the strategy remains in cash. This simple rule aims to capture short-term upward momentum that may follow periods of rising public attention.

To test the effectiveness of this strategy, we conduct backtests across four separate 90-trading-day windows representing distinct market regimes: two bull markets (April–August 2020 and October 2023–March 2024) and two bear markets (April–August 2022 and November 2022–March 2023). For each period, we evaluate two sentiment averaging windows ($m = 5$ and $m = 10$), and five holding durations ($n = 5, 15, 30, 60,$ and 90 days) to measure strategy performance under different configurations.

5. Empirical results:

5.1 Bull market 1: April 1, 2020 – August 11, 2020

This period represents a strong bull market driven by unprecedented monetary stimulus, including near-zero interest rates and large-scale quantitative easing by the Federal Reserve [8]. Tesla's stock price experienced exponential growth, supported by retail investor enthusiasm and optimistic economic recovery expectations.

As shown in Table 1 and figure 1, the buy-and-hold strategy significantly outperformed both sentiment-based strategies across all holding periods. Notably, the 90-day buy-and-hold return reached 2.0171, compared to 0.2545 ($m = 5$) and 0.1987 ($m = 10$). The performance gap widens as the holding period increases, suggesting that in strongly trending bull markets, the sentiment-based signal tends to lag behind due to unnecessary exit signals and missed upside exposure.

Table 1. Performance Comparison Between Sentiment-Based Strategy and Buy-and-Hold

n	Sentiment (m=5)	Sentiment (m=10)	Buy & Hold
5	0.1447	0.0226	0.1327
15	0.1447	0.0226	0.5206
30	0.0726	0.0214	0.6427
60	0.0243	0.2625	1.0477
90	0.2545	0.1987	2.0171

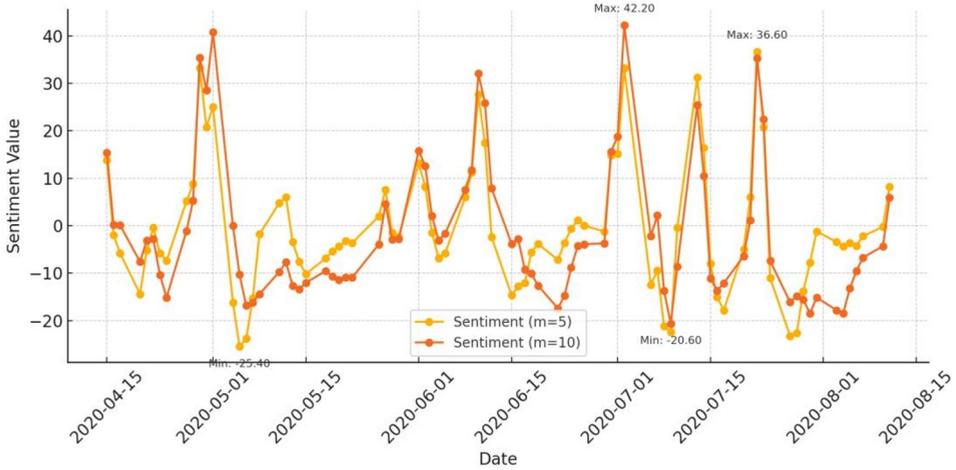


Fig 1. Sentiment Indicator Over Time — Bull Market 1 (2020/04/01 - 2020/08/11)

5.2 Bull market 2: October 30, 2023 – March 11, 2024

This period corresponds to a renewed bull market phase, driven by the anticipation of Fed rate cuts in 2024 and enthusiasm surrounding generative AI technologies. U.S. equity indices such as the Nasdaq 100 reached all-time highs during this period [9]. As shown in Table 2 and Figure 2, the buy-and-hold strategy again outperformed sentiment-based strategies. For example, at $n = 60$, the cumulative return for buy-and-hold was 1.0483, while sentiment strategies recorded 0.4187 ($m = 5$) and 0.4063 ($m = 10$). This suggests that during sustained upward trends, frequent signal-based trading may lead to underexposure and lower returns.

Table 2. Performance Comparison Between Sentiment-Based Strategy and Buy-and-Hold.

n	Sentiment (m=5)	Sentiment (m=10)	Buy & Hold
5	0.0654	-0.0076	0.1145
15	0.0578	-0.0528	0.1836
30	0.0850	-0.0099	0.2355
60	-0.1886	-0.2304	0.0531
90	-0.2123	-0.3156	-0.1116

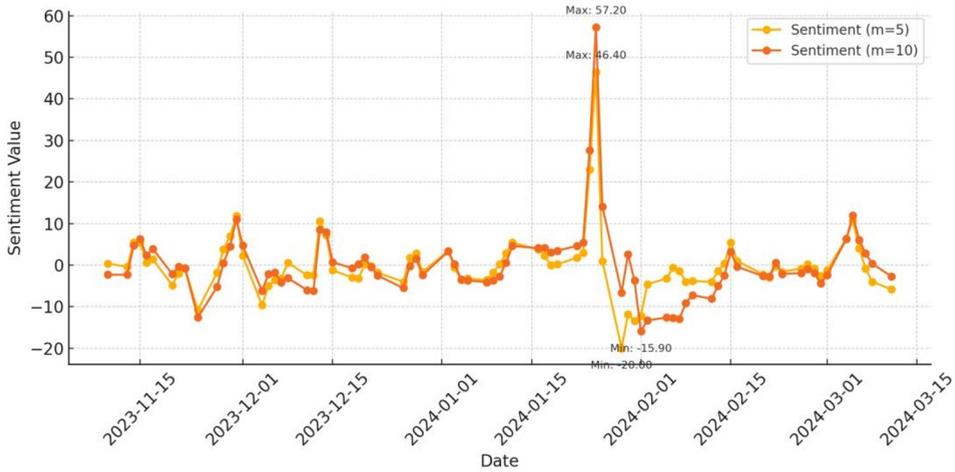


Fig. 2. Sentiment Indicator Over Time — Bull Market 2 (2023/10/30 – 2024/03/11)

5.3 Bear market 1: April 1, 2022 – August 11, 2022

During this period, the U.S. equity market officially entered a bear market, with the S&P 500 falling over 20% from its peak. The Federal Reserve raised interest rates multiple times and began quantitative tightening in response to persistently high inflation [10].

As shown in Table 3 and Figure 3, the sentiment-based strategy outperformed the buy-and-hold approach in several short-term scenarios. For instance, with a holding period of $n = 5$, the $m = 5$ signal yielded a cumulative return of 0.0274, compared to -0.1021 for the buy-and-hold. However, as the holding duration increased, the advantage narrowed or disappeared. These results imply that in volatile or bearish markets, using sentiment momentum may help avoid downside risks in the short run, though its benefit diminishes over time.

Table 3. Performance Comparison Between Sentiment-Based Strategy and Buy-and-Hold.

n	Sentiment (m=5)	Sentiment (m=10)	Buy & Hold
5	0.0113	0.0285	-0.0252
15	-0.0234	0.0221	-0.0699
30	-0.1913	-0.0606	-0.3288
60	-0.2109	0.0020	-0.3225
90	-0.0910	0.0133	-0.1858

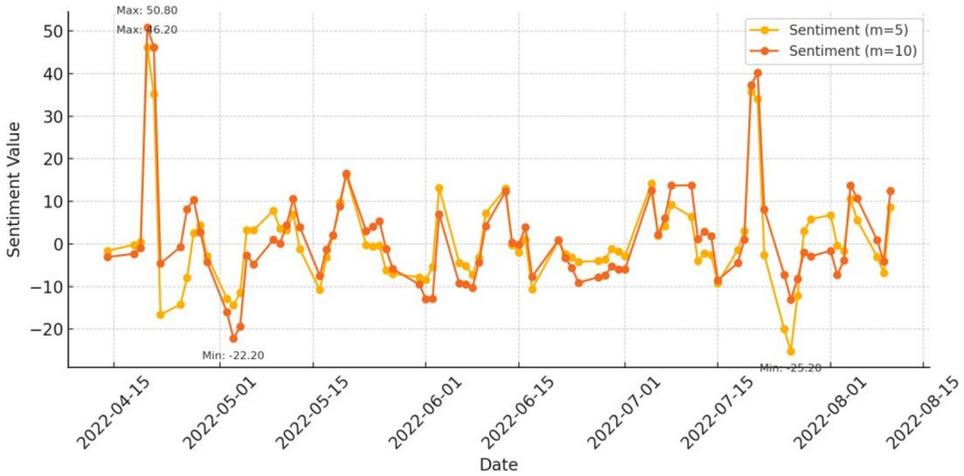


Fig 3. Sentiment Indicator Over Time — Bear Market 1 (2022/04/01 - 2022/08/10)

5.4 Bear market 2: November 1, 2022 - March 14, 2023

The period from November 2022 to March 2023 occurred against the backdrop of a persistent bear market. The Federal Reserve continued its aggressive rate hikes in response to elevated inflation, and investor sentiment remained fragile. Although TSLA experienced a temporary rebound, the broader market was still under significant downward pressure, and recession concerns persisted. This phase is best characterized as a bear market rally rather than the start of a new bull trend. As shown in Table 4 and Figure 4, the sentiment strategy delivered mixed results. While the buy-and-hold strategy produced negative or near-zero returns across all n , the sentiment-based approach showed slightly better outcomes for $m = 5$ with short holding periods. The best relative performance occurred at $n = 15$ with 0.0442 ($m = 5$) versus -0.0113 (buy-and-hold). However, overall returns remained modest. This indicates that during uncertain downtrends, sentiment signals may assist in tactical risk control but are not sufficient to drive substantial profits.

Table 4. Performance Comparison Between Sentiment-Based Strategy and Buy-and-Hold

n	Sentiment ($m=5$)	Sentiment ($m=10$)	Buy & Hold
5	-0.0056	0.0893	-0.1349
15	0.0092	0.1216	-0.2091
30	-0.0214	-0.0931	-0.2634
60	-0.0038	0.0051	-0.2965
90	-0.1093	-0.0471	-0.2341

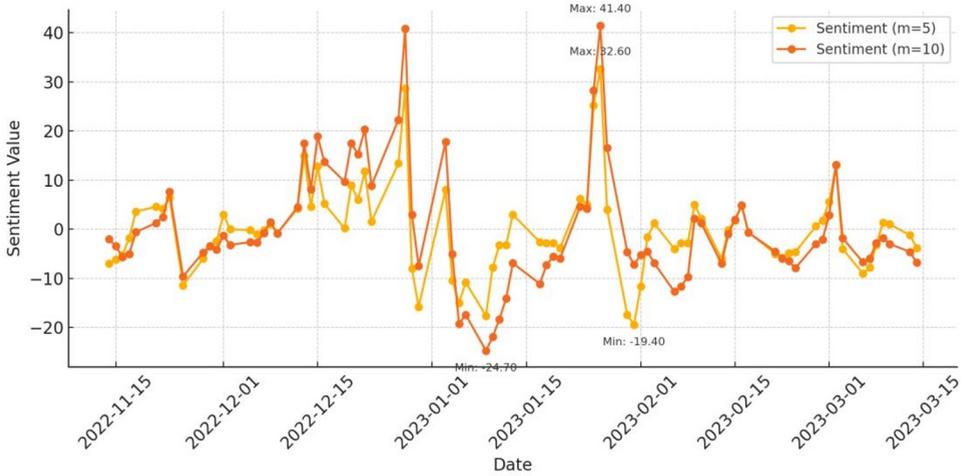


Fig. 4. Sentiment Indicator Over Time — Bear Market 2 (2022/11/01 – 2023/03/14)

6 Conclusion

This paper investigates whether investor sentiment extracted from Google Trends can improve investment performance in the context of Tesla’s stock. By constructing a sentiment momentum indicator based on search volume changes and comparing it against a traditional buy-and-hold strategy, we evaluate performance across different market regimes and parameter settings. Four distinct windows—two bull markets and two bear markets—are selected to assess robustness. Results suggest that the sentiment-based strategy underperforms during strong bull markets but offers certain downside protection in bearish or volatile periods. These findings highlight the potential of public search behavior as a sentiment proxy, especially when used in short-term tactical allocation.

However, this study has several limitations. It focuses solely on one stock and one sentiment data source, and ignores transaction costs or intraday signals. Future work could extend this framework to other asset classes and integrate additional sentiment measures such as Twitter, Reddit, or news sentiment scores for improved prediction.

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