

Exploring the Behavioral Impact of ChatGPT on Investor Sentiment: Evidence from Stock and Cryptocurrency Markets in the Context of Sustainable Development

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ABSTRACT:

This study examines the impact of ChatGPT's release on investment dynamics, particularly focusing on investor sentiment in the stock and cryptocurrency markets. We begin with a bibliometric analysis to assess the current state of the literature in this area. Applying two benchmark sentiment indices the American Association of Individual Investors (AAII) Sentiment Index and the Crypto Fear and Greed Index (FGI) the research explores the behavioral changes prompted by this artificial intelligence technology. Additionally, we broaden the analysis to include investor sentiment in both financial and marketing contexts, considering key market indicators, brand perception, and engagement metrics. As ChatGPT reshapes investor interactions through AI-driven insights, we assess its influence on financial decision-making, corporate strategies, and its potential role in fostering sustainable development. For the methodology, we employed interrupted time series analysis (ITSA) to compare investor sentiment before and after the launch of ChatGPT, revealing significant changes in market behavior. The results indicate that ChatGPT played a catalytic role in enhancing investor optimism. Although the models suggest that ChatGPT accounts for a modest share of the variance in sentiment, its intervention remains statistically significant, underscoring its influence on investor psychology and its relevance for sustainability-oriented perspectives in finance. This paper contributes to the growing literature at the intersection of artificial intelligence and sustainable finance by providing a behavioral perspective on the psychological impact of AI in financial markets. The findings have important implications for market participants, policymakers, and future research on AI-induced financial behavior within the broader framework of sustainable development.

Keywords: ChatGPT, Generative Artificial Intelligence, Investor Sentiment, Behavioral Finance, Stock Market, Interrupted Time Series Analysis (ITSA)

1. Introduction

ChatGPT, an advanced AI language model launched in November 2022, has quickly gained attention for its remarkable ability to generate conversational responses. Based on a combination of reinforcement learning algorithms and human input, the model is using over than 150 billion parameters, making it one of the most complicated examples of Large Language Models (LLMs) ever created. Exploring terabytes of data mainly texts,

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ChatGPT gives responses that closely mimic human communication, positioning it as a ground-breaking tool in a variety of fields. Its impact was immediate within just one week of its launch, the platform attracted over one million users, a number that surged to 100 million by January 2023, along with 616 million monthly website visits soon after (Grant and Metz, 2022; Taecharungroj, 2023). Although this progress, the LLMs' potential to create new research remains underexplored, calling for further study to unlock their transformative impact (Dowling and Lucey, 2023). The rapid adoption of ChatGPT exemplifies how technological innovations can trigger swift emotional responses in markets. Future research should investigate whether the pace of adoption of disruptive technologies correlates with heightened volatility in investor sentiment, as rapid technological diffusion may amplify both optimism and uncertainty.

The launch of ChatGPT has caused a significant increase in research in a number of disciplines, with experts in writing (Warner, 2023), law (Greene, 2022), and education (Herman, 2022) considering how this technology may impact their work and even whether it could result in job displacement. This extensive conversation emphasizes ChatGPT's disruptive qualities and wide-ranging effects. Research on ChatGPT's role in the finance sector has proven very fruitful. Building on our original research, several academics have carried out additional studies, examining different facets of its financial applications; some have even acknowledged our work as a crucial starting point for their own research.

The potential of ChatGPT in financial decision-making and portfolio management has been examined in several research. Romanko et al. (2023), for instance, illustrate ChatGPT's value in investment strategies by demonstrating that it generates a portfolio that outperforms others using stock selection from the S&P 500 and asset weightings derived from its model. Similarly, by suggesting asset classes depending on current economic situations, Kim (2023) discovers that incorporating ChatGPT into quantitative investment models improves portfolio efficiency. Oehler and Horn (2024) contend that ChatGPT offers better financial guidance than robo-advisors for one-time investments, particularly when taking investors' risk tolerance into account. However, Lopez-Lira and Tang (2023) concentrate on ChatGPT's capacity to forecast stock market returns based on news headlines. They discover that ChatGPT's daily stock return forecasts exhibit a positive correlation with actual returns, highlighting its strength in text-based financial data analysis.

Although existing studies predominantly explore the use of ChatGPT in aiding investment decision-making, to the best of our knowledge, no research has directly investigated its influence on investor sentiment. By capturing sentiments in the stock and cryptocurrency markets (Hyungjin et al., 2024), our work focuses on the behavioral aspect. The hypothesis that ChatGPT may affect investor sentiment, which may then affect choices about asset allocation and portfolio management, serves as the driving force for this study. We seek to identify any behavioral changes that might affect investment strategies in these asset classes by investigating how AI-driven responses influence emotional responses to market conditions. While AI-driven optimism can enhance market confidence, it may also foster herd behavior, where investors collectively follow AI-generated sentiment cues. Such dynamics could potentially contribute to speculative bubbles, particularly in volatile sectors like cryptocurrencies.

Beyond its role in financial decision-making, ChatGPT's impact extends to broader behavioral changes in both investment and consumer contexts. Customer experience optimization by generative AI affects loyalty strategies (Arumugam *et al.*, 2024). ChatGPT, as an advanced AI language model, is influencing both customer behavior and investor sentiment within the finance and marketing sectors. Its multifaceted applications are reshaping how businesses interact with investors and how they perceive market dynamics. The rapid advancement of generative artificial intelligence, especially ChatGPT, is changing investor loyalty by improving engagement, customization, and satisfaction.

Building on the body of previous research, our study attempts to investigate the possible influence of ChatGPT on investor sentiment. In particular, we aim to identify the main emotional factors that influence the stock and cryptocurrency markets, such as fear and greed. We investigate the impact of ChatGPT on investor behavior applying an interrupted time series analysis, using two sentiment indexes Fear and Greed Index and AAI (American Association of Individual Investors) sentiment index to represent market sentiment in various asset classes. Additionally, our analysis compares investor behavior before and after ChatGPT's launch and examines a counterfactual scenario to determine how sentiment may have changed if ChatGPT hadn't been released.

Furthermore, investor sentiment is not only shaped by market dynamics but also by broader factors such as marketing strategies and brand perception. In both finance and marketing, sentiment reflects how investors interpret and react to a company's strategic decisions, campaigns, and overall market positioning. Just as ChatGPT influences investment decisions and market sentiment, it is also reshaping how businesses engage with investors through personalized interactions and data-driven insights. Investor sentiment in the finance and also marketing context refers to the overall mood or attitude of investors towards a company's marketing strategies, campaigns, and performance. This sentiment is influenced by factors such as the effectiveness of marketing efforts, investor reactions, brand strength, and overall market trends. Here are several methods for gauging investor sentiment in marketing. The method of Market Indicators such as Volatility Index (VIX). In a marketing context, the VIX can reflect uncertainty regarding a company's future marketing efforts. A high VIX may indicate concerns about the success of a marketing and a finance campaign or the brand's ability to compete, while a lower VIX suggests investor confidence in the company's marketing direction. Another Market Indicators Put/Call Ratio such as a higher ratio could signal investor concerns about a company's marketing effectiveness, while a lower ratio may suggest that investors have confidence in the company's marketing strategies. The method of Fundamental Analysis such as Campaign Performance and Announcements. Investor sentiment can shift based on the results of a company's marketing and finance campaigns or major announcements related to product launches or marketing initiatives. Positive results, such as increased sales driven by a marketing campaign, can lead to optimism, while ineffective campaigns or negative feedback can dampen sentiment. The method of Technical Indicators such as Brand Performance Trends. Positive brand growth or increased investor engagement from marketing efforts may reflect a bullish sentiment, while a decline in brand recognition or customer loyalty may point to bearish sentiment. Engagement Volume consisting of increased investor engagement (such as social media interactions, purchases, or website traffic) driven by marketing campaigns suggests higher investor confidence. Conversely,

low engagement or lackluster results may cause skepticism among investors. The method of Sentiment Surveys such as Consumer Feedback and Sentiment Analysis. Consisting of Surveys, market research, and sentiment analysis tools can help gauge how investors feel about a company's marketing and finance messages, products, or campaigns. Positive sentiment from investor often leads to a more favorable investor outlook. Investor sentiment toward a company's marketing efforts plays a significant role in shaping its stock price and market perception. Effective marketing campaigns that resonate with consumers can boost investor confidence and lead to increased market value, while poor marketing performance can do the opposite, potentially hurting a company's reputation and stock price. ChatGPT is transforming marketing by enabling personalized investor interactions and providing deep insights into investor behavior (Nwachukwu & Affen, 2023). Simultaneously, it influences investor sentiment by offering sophisticated tools for market analysis and decision-making support. As AI technology continues to evolve, its role in shaping both investor behaviors is expected to expand further. In today's fast-changing digital world, organizations use generative AI, like ChatGPT, to boost investor loyalty and engagement (Sofiyah et al., 2024; Rane et al., 2024; Rahmoune & Alsaggaf, 2025).

Beyond its implications for financial markets and marketing strategies, the integration of generative artificial intelligence such as ChatGPT can also be situated within the broader discourse on development and sustainability. Recent studies have stressed that financial innovation should not be evaluated solely in terms of short-term profitability but also in light of its contribution to long-term economic resilience, transparency, and inclusiveness. In this regard, the behavioral changes induced by ChatGPT may be understood as part of a larger transformation towards sustainable finance, where technological progress is aligned with the objectives of balanced development and responsible market practices. Incorporating generative AI into finance also raises governance challenges. Ensuring equitable access, algorithmic transparency, and ethical oversight becomes critical to maintain trust and prevent the amplification of systemic inequalities. Such an approach highlights both opportunities and risks: while generative AI may enhance market efficiency and strengthen investor confidence, it also raises important questions about ethical standards, regulatory oversight, and the risk of reinforcing inequalities if access and governance are not adequately addressed. Positioning this study within the sustainability framework therefore allows us to underline the dual role of ChatGPT as a disruptive technological innovation and as a potential driver of more sustainable and development-oriented financial systems (Drempetic et al., 2020; Bansal et al., 2022).

The structure of our study is as follows. In Section 2, we present a bibliometric analysis and the methodology employed along with the variables used. Section 3 outlines our empirical findings with the robustness test. Finally, Section 4 concludes our study.

2. Data and Methodology:

2.1. Bibliometric analysis:

Figure 1 classify publications by countries. China, USA, and India dominate the research landscape, which may reflect their investment in research and development, higher education systems, and collaborative networks. Countries like Germany, the United Kingdom, and Korea also show a significant presence, suggesting a well-established research infrastructure.

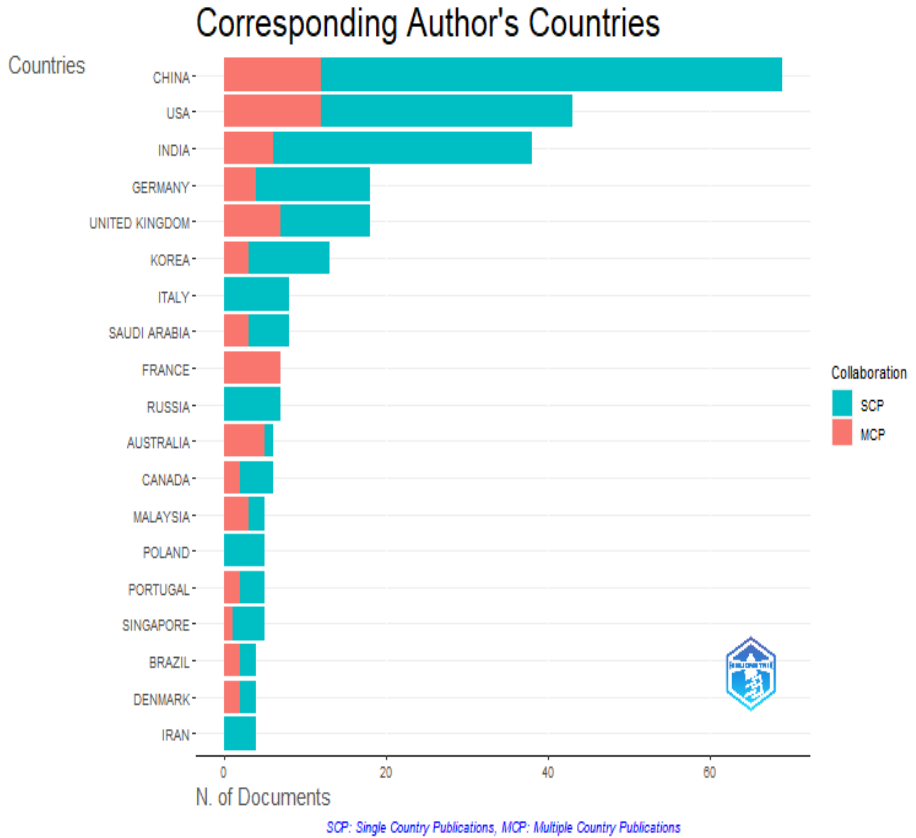


Figure 1: Top Publishing Countries in ChatGPT and Finance Research

Figure 2, illustrate the collaboration patterns Multi-Country Publications (MCP): The presence of multi-country publications indicates collaboration trends. For example, while China has a high number of articles, its MCP ratio is lower compared to some other countries, suggesting it may focus more on domestic publications. High MCP Ratios: Countries like France (MCP Ratio = 1) have high collaboration rates, indicating a strong propensity to engage in international research partnerships.

Country Scientific Production

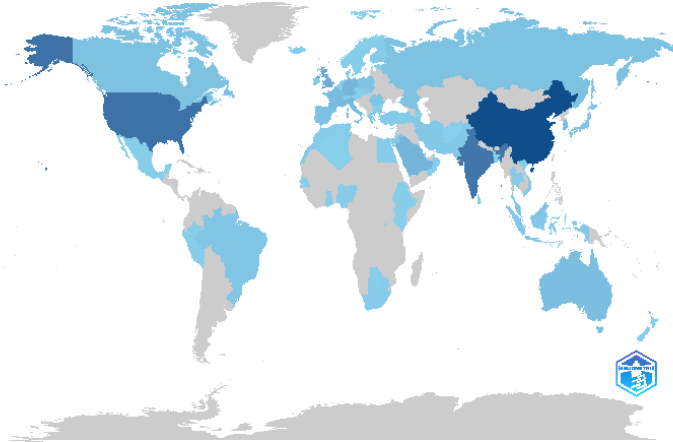


Figure 2: International Collaboration Patterns in ChatGPT and Finance Research

Figure 3 illustrate the Author Influence and their Citation Impact: Local Citations: High local citations can indicate an author's strong influence within their local academic community. For instance, authors with 6 or more local citations may be key figures in specific research areas or institutions.

Fractionalized Contributions: The fractionalized articles metric allows for a better understanding of an author's true contribution, especially in co-authored works. Authors like Ghosh I show a higher impact when considering fractionalization.

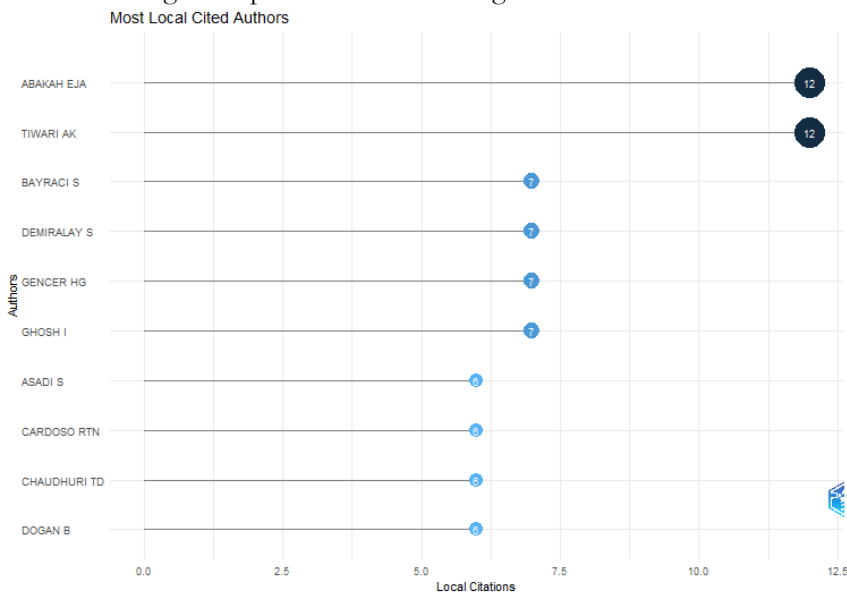


Figure 3. Author Influence and Citation Impact

particularly in understanding how sentiment impacts asset pricing. AI technologies, including chatbots like ChatGPT, play a vital role in analyzing investor sentiment. They process large datasets, provide real-time insights, and personalize financial advice through advanced sentiment analysis tools. This integration enhances decision-making, market predictions, and poses ethical considerations regarding transparency and bias.

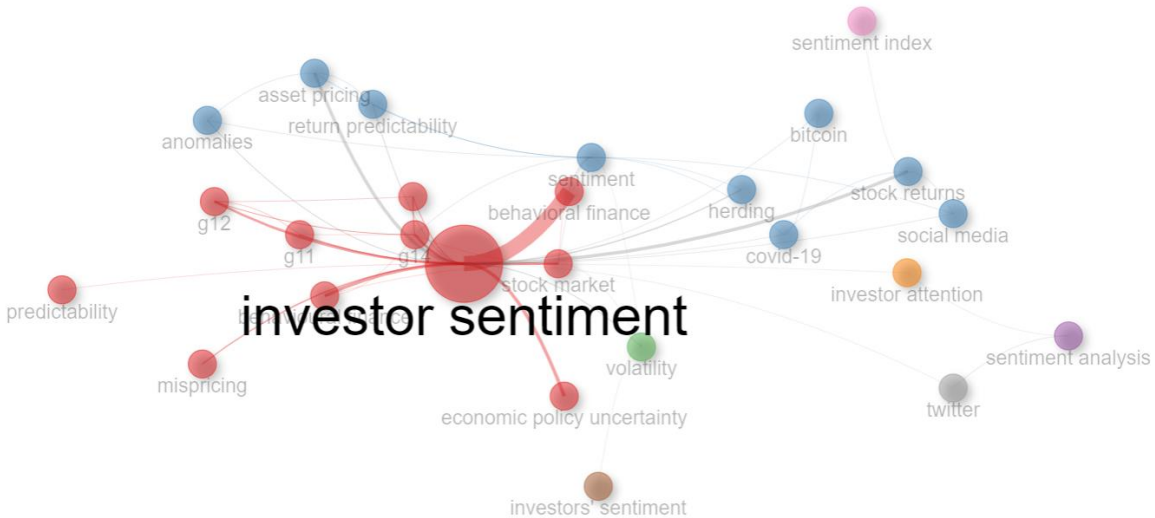


Figure 5. Co-occurrence Network of Investor Sentiment and Related Themes

2.1 Data:

We analyze weekly data from two behavioral indexes associated with the stock and cryptocurrency markets, covering the period from January 1, 2020, to December 1, 2024. First index is Crypto Fear & Greed Index (FGI) was developed by the team behind (Alternative.me)¹, which is regarded as the most widely utilized sentiment indicator currently used in the cryptocurrency market. The FGI uses a left-to-right moving needle and measurements ranging from 0 to 100 to indicate whether investors feel brave or afraid. The more afraid investors are represented by the lower value, and the higher value represents the greedier investors. Recently, it has garnered significant attention due to numerous major social events and the growing interest of researchers in studying investor behavior towards cryptocurrencies. Wang J et al (2024), Gais B et al (2023) and Mengxi H et al (2023).

The second index is the American Association of Individual Investors (AAII) Sentiment Index, a widely recognized measure of investor sentiment in the stock market. The percentage of traders who are bullish, bearish, or neutral about the direction of the stock market over the next six months is reflected in this index. The AAII feelings Index is an

¹ <https://alternative.me/crypto/fear-and-greed-index/>

effective tool to measure market mood and forecasting future market changes since it tracks the percentage of optimistic and pessimistic investors. As shown by studies like **Liu S** (2015), **Rodriguez N et al.** (2024), and **Zhifang H** (2022), this index has been widely used in academic research to examine investor behavior and market dynamics.

To convert these sentiment percentages (Bullish, Neutral, Bearish) into a single index value for each date, we created a weighted index. By assigning weights to each sentiment category and compute a composite score.

$$\text{AAII Index} = \omega_1 \cdot \text{Bullish} + \omega_2 \cdot \text{Neutral} - \omega_3 \cdot \text{Bearish} \quad (1)$$

Where:

$\omega_1, \omega_2, \omega_3$ are the weights assigned to Bullish, Neutral, and Bearish.

2.2 Methodology

We performed interrupted time series analysis (ITSA) to analyze the effects of the release of ChatGPT on investors' sentiments. In interrupted time series studies, segmented regression analysis effectively estimates the intervention's results. In this study, the model was constructed as follows:

$$Y_t = \beta_0 + \beta_1 \cdot \text{Time}_t + \beta_2 \cdot \text{ChatGPT}_t + \beta_3 \cdot \text{TimeAfterChatGPT}_t + \varepsilon_t \quad (2)$$

Where Y_t is the dependent variable representing the sentiment indexes (AAII Index and Fear and Greed Index). Time, ChatGPT, and time after ChatGPT were considered as the independent variables. The variable ChatGPT was assigned 0 before the release of ChatGPT (November 2022) and 1 after its release.

β_0 is the level of explained variables at baseline.

β_1 estimates the baseline trend before the release of ChatGPT.

β_2 estimates the immediate effect of ChatGPT's release on the dependent variable.

β_3 reflects the change in trend after the release of ChatGPT (change in slope).

ε_t is the error term.

3. Empirical results

The findings of the Interrupted Time Series Analysis (ITSA) of ChatGPT's effect on the Fear and Greed Index are shown in **Table 1**. With a R^2 value of 0.065, indicating that 6.5% of the variance in Cryptocurrency sentiment Index can be attributed to the intervention. Although the R^2 value is relatively low, the results still provide evidence of a statistically significant effect. The modest R^2 values suggest that ChatGPT's influence, while statistically significant, operates within a complex behavioral ecosystem. External factors such as macroeconomic conditions, media sentiment, and geopolitical events likely interact with AI-induced optimism to shape investor emotions. The dummy variable for the intervention (ChatGPT's release) has a coefficient of 11.30 ($p=4.03 \times 10^{-5}$), with a 95% confidence interval [5.98 to 16.63]. This suggests that the release of ChatGPT resulted in a significant increase in the Fear and Greed Index, indicating heightened emotions both fear and greed among market participants. The F-statistic ($F = 17.47$, $p=4.03 \times 10^{-5}$) confirms that the model explains a statistically significant portion of the variation in the

index. With an intercept coefficient (44.99, $p < 0.001$) which represent the baseline level of the Fear and Greed Index prior to the intervention.

The second analysis focused on the AAI Index presented in **table 2**. The model showed an R^2 value of 0.102, indicating that 10.2% of the variation in the AAI Index is explained by the intervention. With a significant positive effect of the dummy variable, with a coefficient of 12.60 ($p = 1.74 \times 10^{-7}$), and a 95% confidence interval ranging from 7.98 to 17.22. This implies that the release of ChatGPT also caused the AAI Index to noticeably increase, reflecting heightened optimism or sentiment among individual investors. The significant F-statistic ($F = 28.88, p = 1.74 \times 10^{-7}$) reinforces the strength of the model, despite a modest R^2 .

Table 1: the Interrupted Time Series Analysis (ITSA) of ChatGPT's effect on the Fear and Greed Index output

<i>Regression Statistics</i>	
Multiple R	0,25413711
R Square	0,06458567
Adjusted R Square	0,06088838
Standard Error	21,2220788
Observations	255

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	7867,351206	7867,351	17,46838	4,03E-05
Residual	253	113945,2873	450,3766		
Total	254	121812,6385			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95,0%</i>	<i>Upper 95,0%</i>
Intercept	44,9867	1,727	26,048	1,44E-73	41,585572	48,387938	41,585571	48,387938
dummy	11,3026	2,7042	4,179519	4,03E-05	5,9768395	16,628405	5,9768395	16,628405

Table 2: the Interrupted Time Series Analysis (ITSA) of ChatGPT's effect on the AAI Index output

<i>Regression Statistics</i>	
Multiple R	0,32010402
R Square	0,102466583

Adjusted Square	R	0,09891902
Standard Error		18,40082077
Observations		255

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	9779,722675	9779,723	28,88366	1,74E-07
Residual	253	85663,32186	338,5902		
Total	254	95443,04454			

	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95,0%</i>	<i>Upper 95,0%</i>
Intercept	4,7591973	1,4974375	3,1782	0,00166	7,708228	1,810166	7,708228	1,810166
dummy	12,601673	2,3447802	5,37435	1,00E-07	7,9838987	17,219447	7,983898	17,219447

4. Robustness Test: A Graphical Analysis

To study the influence of ChatGPT's release on market sentiment (cryptocurrencies and stocks market): the Fear and Greed Index (**Figure 6**) and the AAI Index (**Figure 7**). Using Python and applying the Facebook Prophet model for forecasting, hypothetical scenarios were generated to predict the evolution of these indices had ChatGPT not been released. These predictions (red lines) were then compared against the observed real values (blue lines) to identify deviations.

Figure 6 shows a clear difference between the predicted and actual values after the ChatGPT's release. Before ChatGPT, the Fear and Greed Index followed the expected trajectory. However, after its launch, the observed values increase sharply, suggesting increased investor optimism or speculative activity. This upward trend underlines the significant impact of ChatGPT on cryptocurrencies market sentiment, with actual values consistently exceeding the predictions throughout the year studied.

Figure 7 extends this analysis by focusing on the AAI index. As in Figure 6, a difference emerges after the launch of ChatGPT, with actual values showing greater volatility and an upward trend compared to the predicted stable scenario. This phenomenon is particularly visible in mid-2023, where actual values significantly exceed predicted levels. The observed volatility suggests that the launch of ChatGPT not only brought optimism, but also influenced the variability of investor sentiment.

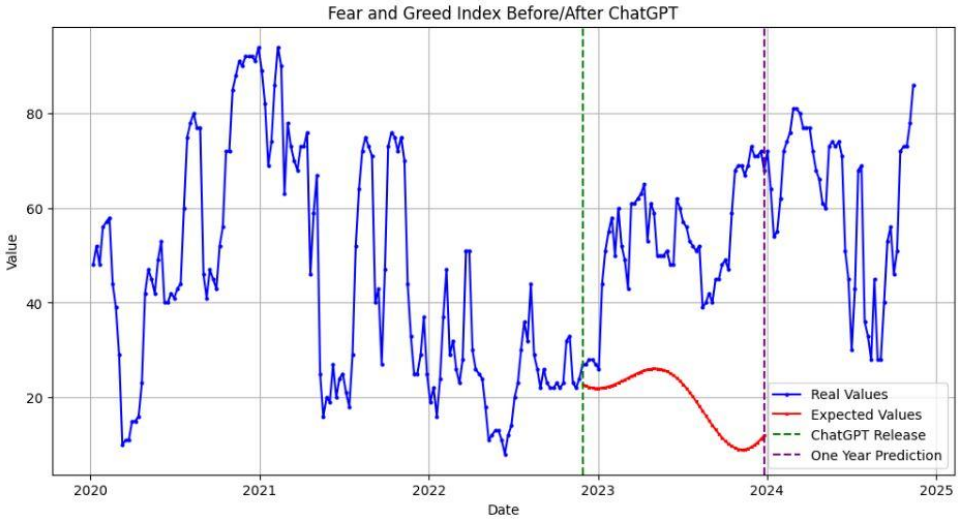


Figure 6: Fear and Greed Index Before/ After ChatGPT

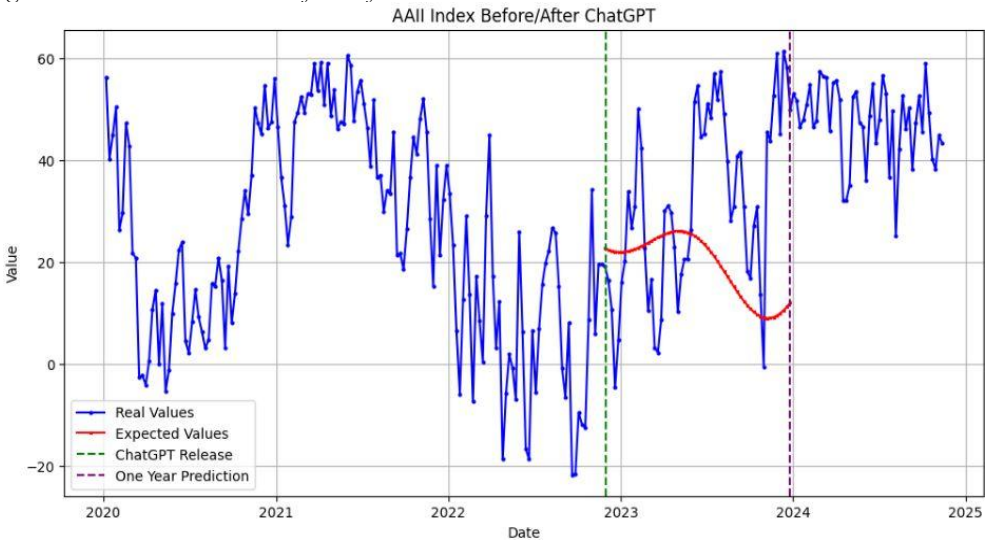


Figure 7: AAII index Before/ After ChatGPT

5. Conclusion

This study explores the impact of the launch of ChatGPT on investor sentiment in the stock and cryptocurrency markets. Using interrupted time series analysis (ITSA) and two key sentiment indices, the Crypto Fear & Greed Index (FGI) and the American Association of Individual Investors (AAII) Sentiment Index, we provide empirical evidence of the significant influence of this AI technology on market behavior. Although the R² values of the models show that ChatGPT explains only a modest portion of the variance in sentiment, the statistical significance of the intervention highlights its important role in investor psychology.

Comparative analysis of the two indices reveals the multiple and significant impact of ChatGPT on market sentiment. Both indices indicate an overall increase in investor optimism and confidence. However, the Fear & Greed Index shows a more pronounced risk appetite, while the AAI Index reflects changes in individual investor sentiment. Using the Facebook Prophet model to create counterfactual scenarios, we isolated the effects of the ChatGPT launch. The observed differences between actual and predicted values for both indices suggest that ChatGPT played a catalytic role in behavioral changes in financial markets, influencing institutional and individual sentiments.

This research adds to the growing literature on the role of AI in finance by providing a behavioral perspective, shifting the focus from its functional applications to its psychological implications. Recent studies indicate that ChatGPT can analyze social media sentiment and news headlines to forecast stock trends, demonstrating a positive correlation between its predictions and actual market movements for major companies like Microsoft and Google (Mumtaz & Mumtaz, 2024). However, while fine-tuning ChatGPT has improved its performance in stock forecasting, it still faces challenges in integrating time series data effectively compared to traditional models (Huang *et al.*, 2024). Future studies could further explore these findings by examining the complex dynamics of AI-driven sentiment changes across different asset classes, market conditions, and geographic regions. Furthermore, studying the long-term impacts of AI-driven sentiment changes on financial stability and investor well-being offers a promising avenue for further research. Future studies should adopt a cross-market approach, assessing the persistence of AI-induced sentiment shifts across asset classes and economic cycles. Evaluating whether reliance on AI strengthens financial resilience or introduces new systemic vulnerabilities will be critical.

The implications of these findings extend beyond academia. For policymakers, understanding AI's influence on market sentiment is crucial for designing regulations that limit the volatility risks associated with algorithm-driven behavioral changes. Financial industry professionals can use this information to develop more robust investment strategies and reduce emotional biases among market participants. The results also highlight how crucial it is to inform investors about the various ways in which ChatGPT and other AI technologies affect their decision-making processes. As a result, the market will become more knowledgeable and dynamic. To maintain confidence and stability in global markets, it is imperative to guarantee accountability and transparency in the application of AI as it becomes further incorporated into the financial sector.

In addition to its implications for finance and investor psychology, this study can also be positioned within the broader discourse of sustainable development (**Rahmoune & Debabi**, 2012). Technological innovations such as ChatGPT should not only be assessed in terms of their immediate financial impact but also in relation to their contribution to long-term sustainability, resilience, and inclusiveness of economic systems. By influencing investor sentiment and shaping market behavior, generative AI has the potential to support more transparent, efficient, and responsible financial practices. However, it also raises important challenges related to governance, equity of access, and ethical accountability. Framing the findings of this research in the context of sustainable development emphasizes the dual nature of ChatGPT's influence: it is both a disruptive force that reshapes markets and a potential driver for aligning financial innovation with sustainability-

oriented objectives. By merging insights from behavioral finance and sustainability studies, this work emphasizes the dual nature of AI: a disruptive innovation and a potential enabler of responsible, inclusive financial ecosystems.

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