Sentiment, Risk, and Market Shock: The Impact of AI Risk Disclosures on Stock Reactions to DeepSeek_R1

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Abstract

This study explores how the sentiment of AI risk disclosures affects stock market reactions to the DeepSeek_R1 event. Analysing 10-K reports of IT companies using FinBERT, we find that firms with more optimistic AI risk disclosures experience significantly stronger negative market reactions. This suggests that overly optimistic disclosures may lead investors to underestimate potential AI risks. Our research offers new empirical evidence on the downsides of optimistic AI risk disclosures and underscores the need for balanced risk communication. The findings have practical implications for investors and provide insights for managers and regulators addressing emerging technological risk disclosure issues.

JEL Classifications: G12, G14, O33

Keywords: AI risk, Risk disclosure, Sentiment, DeepSeek, Market reaction

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1. Introduction

The recent introduction of DeepSeek_R1 (DeepSeek henceforth) poses a substantial risk to information technology (IT) firms by potentially disrupting current market dynamics and competitive landscapes. Unlike other artificial intelligence (AI) models that demand extensive computing power, DeepSeek is engineered to function with significantly fewer computational resources[1], potentially reshaping industry benchmarks for data processing efficiency, resource utilization, and user experience. This innovation presents a dual threat to the IT sector: established firms risk losing market share if they fail to adapt swiftly, while new entrants may exploit the technology to gain a competitive advantage. As such, advancements in AI introduce new forms of risk for the IT industry. We refer to these as AI risks, which have the potential to trigger a repricing of IT stocks.

In the U.S., listed companies must disclose firm-specific risks in Item 1.A of their 10-K reports. Given the IT sector's exposure to AI risks, IT firms are expected to communicate management's foresight on such risks, termed AI risk disclosure, through this section. These disclosures signal the potential financial impact if AI risks materialise. The sentiment expressed serves as a key indicator of how management perceives these threats, with the tone, whether cautious, optimistic, or urgent, reflecting the level of concern and strategic importance attributed to AI-related developments.

Managers' sentiment in AI risk disclosures can influence investor reactions to stock prices in two contrasting ways when AI risks materialise. First, an optimistic tone, highlighting preparedness and strategic readiness, may reassure investors about a firm's resilience. This can lead to more stable stock prices, as investors perceive management as capable of managing emerging AI challenges. In this case, optimistic sentiment helps anchor expectations and cushions the market response when risks occur. Alternatively, an overly optimistic tone may foster investor complacency, causing them to underestimate both the likelihood and potential impact of future AI-related disruptions. If an AI risk materialises contrary to these positive expectations, the market reaction may be more severe. Investors, caught off guard by the discrepancy between management's prior assurances and unfolding events, may respond with heightened concern, prompting sharp selloffs or significant downward revisions in valuation. These two divergent pathways highlight the dual role of optimistic sentiment, it can either mitigate or amplify market reactions depending on how expectations are managed. Accordingly, we propose two opposing predictions regarding stock market responses to the DeepSeek event based on AI risk disclosure sentiment: (1) more optimistic sentiment is associated with less adverse reactions, and (2) more optimistic sentiment is associated with more adverse reactions, when AI risk materialises.

This study examines how AI risk disclosure sentiment influences stock market reactions to the DeepSeek event. We employ FinBERT (Huang et al., 2023), a cutting-edge financial text classification model, to measure sentiment in Item 1.A of IT firms' 10-K reports. FinBERT has proven effective in capturing various sentiment types, including investor (Gao et al., 2024, Dolaeva et al., 2025), news (Hajek and Henriques, 2024, Kirtac and Germano, 2024), public (Ma and Wang, 2025), bank risk-culture (Semeyutin et al., 2023), and credit ratings (Jiang et al., 2024). To our knowledge, sentiment in AI risk disclosures remains unexplored.

[1] 'DeepSeek-V3 Technical Report', *arXiv*, https://arxiv.org/html/2412.19437v1, (accessed 26 February 2025).

To assess the impact of AI risk disclosure sentiment on market reactions to the DeepSeek event, we first sort IT stocks into High, Medium, and Low sentiment portfolios based on their AI risk disclosure sentiment scores. We then estimate cumulative average abnormal returns (CAAR) for each group. Consistent with our second prediction, we find that the IT sector responds negatively to the DeepSeek event, with the most pronounced negative reaction concentrated in the High sentiment group. For robustness, we control for sub-industry effects within the IT sector by conducting a double-sorting procedure. Specifically, we classify stocks into semiconductors, technology hardware & equipment, and software & services, and then further sort them by sentiment within each sub-industry. This method isolates the sentiment effect from industry-specific sensitivities to AI risks. Results consistently show that stocks with higher sentiment experience stronger negative reactions, particularly within the semiconductors and technology hardware & equipment groups. Our cross-sectional regression analysis further supports this finding, revealing a significant negative relationship between AI risk disclosure sentiment and CAR across multiple event windows. These results reinforce our second prediction: more optimistic AI risk sentiment is linked to more adverse stock market reactions when AI risks materialise.

This study offers three novel contributions. First, it is the first to examine how AI risk disclosure sentiment influences stock market reactions to the DeepSeek event, highlighting the importance of AI risk disclosure in financial markets. Second, it uncovers a negative link between disclosure sentiment and stock returns, raising questions about the reliability of AI risk-related information in 10-K reports. Third, we introduce a new method to measure managerial sentiment on AI risks, opening pathways for further research on AI risk, corporate disclosure, and financial market behaviour.

2. Sample

Our initial sample included 737 IT companies identified using GSCI industry codes and SEC EDGAR CIK numbers. We downloaded 10-K reports from 566 companies for 2024 using the SEC API. Item 1.A of each report was extracted, with text formatted and split into sentences using NLTK library's sentence tokeniser. We identified sentences containing AI-related keywords, including "artificial intelligence," "machine learning," "AI," "ML," "ChatGPT," "NLP," and "Generative AI." Companies without these keywords in Item 1.A were excluded, resulting in a final sample of 300 IT companies disclosing AI-related risks in 2024.

We define January 27, 2025, as the DeepSeek event day, marking the moment it surpassed ChatGPT in the U.S. App Store download rankings[2]. Although DeepSeek officially launched on January 20, we chose not to use this date as the event day, as the stock market typically requires time to process and evaluate the implications of new technology for IT companies. The surpassing of ChatGPT on January 27 indicates DeepSeek's growing market presence and industry impact. Additionally, Google Trends data shows a significant spike in searches for DeepSeek around this date (See Figure 1), signaling increased public interest and reinforcing our choice of January 27 as the event day.

[2] 'China's DeepSeek AI tops ChatGPT on App Store: What you should know', *CNBC Technology*, 27 January 2025, www.cnbc.com/2025/01/27/chinas-deepseek-ai-tops-chatgpt-app-store-what-you-should-know.html, (accessed 26 February 2025).
'What is DeepSeek? China's AI challenges the West', *The New York Times*, 27 January 2025, www.nytimes.com/2025/01/27/technology/what-is-deepseek-china-ai.html, (accessed: 26 February 2025).

[Insert Figure 1 about here]

3. Research method

3.1 AI risk disclosure sentiment score estimation

FinBERT, proposed by Huang et al. (2022), is a large language model designed to measure sentiment in financial texts, including public sentiment (Jin and Lin, 2025) and employee sentiment (Chen et al., 2023). Following Huang et al. (2022), we use FinBERT to analyse AI-related sentences in Item 1.A of 10-K reports, assigning a sentiment label, positive, negative, or neutral, to each sentence. The AI risk disclosure sentiment score is calculated as the percentage of positive sentences minus the percentage of negative ones, and raw sentiment scores are normalised using Z-scores.

3.2 Stock market reaction measure

We use cumulative average abnormal return (CAAR) to measure stock market reactions to the risk event. Following MacKinlay's (1997) event study methodology, we define the event window from day t-5 to day t+5 (i.e., January 16 to February 3, 2025). The estimation window spans 120 trading days, from day t-125 to day t-6. Expected stock returns are estimated using the market model:

$$E(R_{i,t}) = \alpha_i + \beta_i R_{m,t} \qquad (1)$$

where $R_{m,t}$ is the market factor proxied by the returns of S&P 500 index. α_i and β_i parameters are estimated over the pre-event period of 120 trading days using OLS regression. Next, abnormal returns are calculated as the deviation of actual returns from their expected values:

$$AR_{i,t} = R_{i,t} - E\left(R_{i,t}\right) \qquad (2)$$

where $R_{i,t}$ is the actual return of the stock *i* on day *t*. To evaluate the event's cumulative impact, we first compute the cumulative abnormal return for each stock over the event window and then calculate the cumulative average abnormal return as:

$$CAAR_t = \frac{1}{N}\sum_{i=1}^{N} CAR_{i,t} \qquad (3)$$

3.3 Examining market reactions

We categorize 300 IT stocks equally into three groups, High, Medium, and Low sentiment groups, based on their AI risk disclosure sentiment scores. Stocks in the High sentiment group have more optimistic AI risk disclosure sentiment than those in Medium and Low sentiment groups. We then calculate the *CAAR* for the entire sample and for each sentiment group over the event window. This analysis aims to assess how market reactions to the DeepSeek event vary depending on managers' AI risk disclosure sentiments.

3.4 High AI risk disclosure sentiment and stock returns

We use the following cross-sectional regression model to examine if high AI risk disclosure sentiment is associated with low stock returns:

$$CAR_i = \alpha + \beta_1 High\_sentiment_i + \beta_2 MV_i + \beta_3 Liquidity_i + \beta_3 Volatility_i + \varepsilon \quad (4)$$

The dependent variable is cumulative abnormal returns (*CAR*) for individual IT stocks across 12 event windows. The key variable is *High_sentiment*, a dummy variable set to 1 if the stock belongs to the High sentiment group, and 0 otherwise (as defined in Section 3.3). MV represents the market equity value on the event day, *Liquidity* is proxied by the log of stock turnover by value, and *Volatility* is the historical 12-month stock price volatility. Stock market data is sourced from LSEG (formerly Refinitiv).

4. Empirical results

Table 1 presents the summary statistics for abnormal returns across the entire sample and by sentiment groups on the event day. The mean abnormal return for the full sample is -1.3205%, suggesting an overall negative market reaction. Companies in the high sentiment group experienced the most significant negative reaction, with a mean of -2.7007%, while those in the medium sentiment group had the weakest negative reaction, with a mean of -0.2789%. Notably, the low sentiment group outperformed the high sentiment group in terms of mean abnormal return, suggesting that more optimistic sentiment leads to stronger adverse reactions when AI risks materialise.

[Insert Table 1 about here]

Table 2 reports AAR and CAAR for the entire sample and the three sentiment groups over the event window, with CAAR trends clearly illustrated in Figure 2. Among the sentiment groups, the high sentiment group shows the strongest negative reaction, followed by the low sentiment group. Additionally, the CAAR of the high sentiment group is statistically significant at the 1% level from the event day to Day t+3, confirming the significance of the negative response to the DeepSeek event. These findings strongly support our second prediction that more optimistic sentiment leads to more adverse reactions when AI risk materialises.

[Insert Table 2 about here]

[Insert Figure 2 about here]

We further categorise IT stocks into three industry groups—semiconductors, technology hardware & equipment, and software & services—using GICS industry codes, as each group is impacted by DeepSeek's technological demands and opportunities differently. Within each industry group, stocks are sorted into High, Medium, and Low sentiment groups to investigate whether higher AI risk disclosure sentiment is linked to more negative market reactions. The results, shown in Table 3, reveal that high sentiment groups consistently show the strongest negative reactions in terms of CAAR, particularly in semiconductors and technology hardware & equipment, supporting our second prediction while accounting for sub-industry effects.

[Insert Table 3 about here]

To test the robustness of our findings, we conduct cross-sectional regressions to examine the link between high AI risk disclosure sentiment and returns. Table 4 presents the regression results, showing strong evidence that negative CAR is associated with high AI risk disclosure sentiment, with eight out of twelve negative coefficients for the High_sentiment variable being statistically significant. Overall, our analysis highlights the importance of AI risk disclosure sentiment in market reactions, suggesting that high sentiment is associated with adverse outcomes.

[Insert Table 4 about here]

5. Conclusion

This study provides novel evidence on the crucial role of AI risk disclosures in shaping market reactions. Our analysis of IT companies' responses to the DeepSeek event reveals that overly optimistic sentiment can inadvertently amplify adverse stock market reactions when AI risks materialise. This highlights the need for a shift in corporate communication strategies, advocating for a more sophisticated approach. Policymakers should consider incentivising standardised frameworks for AI risk reporting to enhance comparability and transparency. Future research should explore communication strategies that mitigate the risks of AI challenges, promoting market stability and informed investment decisions in an increasingly AI-driven financial landscape.

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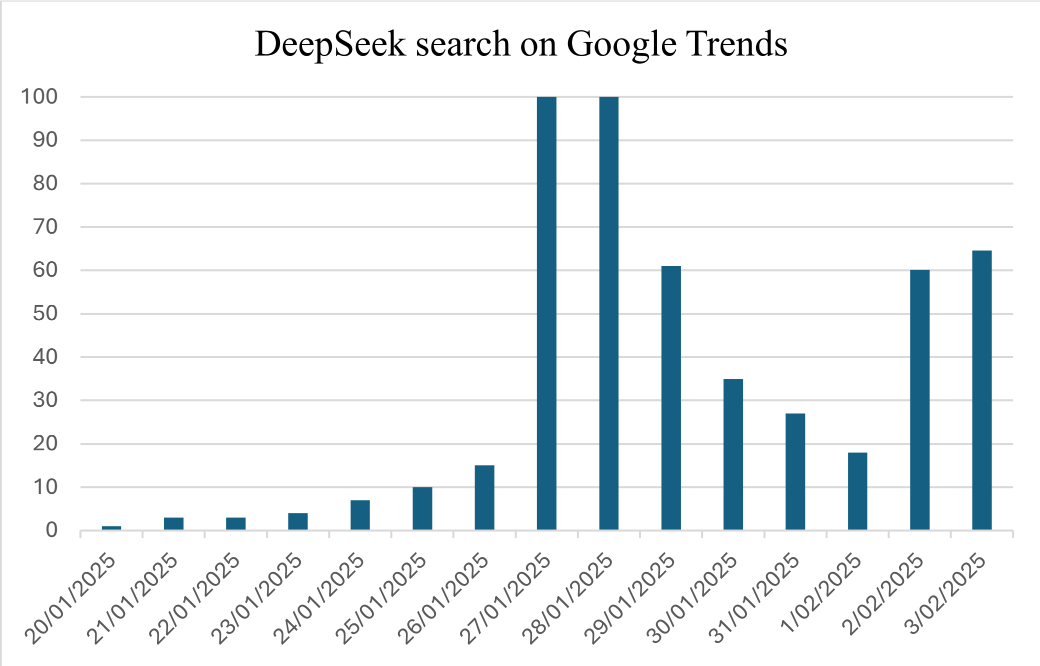
Figure 1. Google Trends Search Index on DeepSeek



Note: A Google Trends value represents the relative popularity of a search term on a scale from 0 to 100, where "100" indicates the peak popularity for that term within a specific time frame and location.

Figure 2. CAAR for the Whole Sample and Sentiment Groups

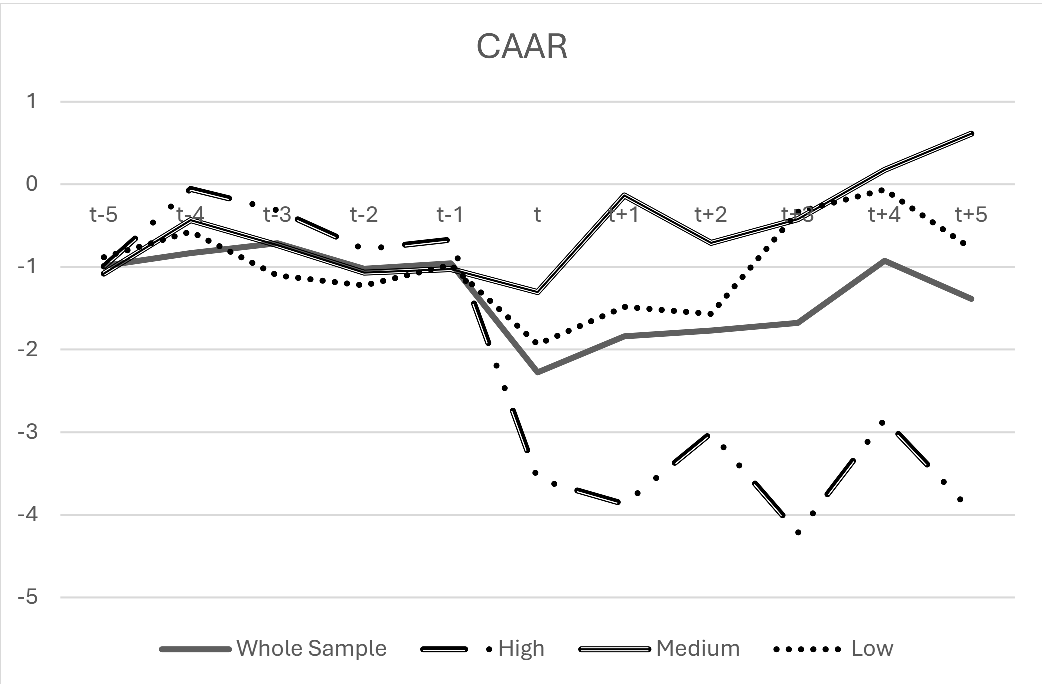


Table 1. Summary Statistics

	Whole sample	High Sentiment	Medium sentiment	Low Sentiment
Mean	-1.321	-2.701	-0.279	-0.961
Standard Deviation	6.627	7.358	5.855	6.393
Minimum	-33.537	-27.970	-21.707	-33.537
25%	-3.373	-4.368	-2.698	-3.226
50%	0.238	-0.797	0.508	0.767
75%	2.779	2.319	2.754	3.284
Maximum	24.181	8.768	24.181	12.650
No. of companies	300	100	100	100

Note: The table shows the summary statistics for the abnormal returns of the whole sample and the three sentiment groups on January 27, 2025, which is defined as the DeepSeek event day. The numbers are in percentages, except for the values for the number of companies.

Table 2. AAR and CAAR

Panel A: Whole sample	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
AAR	-0.987[a]	0.636[b]	-0.362	-0.311	0.068	-1.321[a]	0.438	0.070	0.092	0.751[b]	-0.461
t-stat	-3.221	2.089	-1.375	-1.118	0.215	-3.480	1.469	0.204	0.232	2.441	-1.432
CAAR	-0.987[a]	-0.351	-0.713	-1.024[c]	-0.956[c]	-2.276[a]	-1.838[a]	-1.768[b]	-1.676[b]	-0.925	-1.386
t-stat	-3.221	-0.822	-1.595	-1.789	-1.839	-3.875	-2.736	-2.413	-2.271	-1.210	-1.572
Panel B: High	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
AAR	-0.997	0.940	-0.257	-0.474	-0.082	-2.701[a]	-0.301	0.859	-1.209[c]	1.372[c]	-1.108
t-stat	-1.362	1.252	-0.406	-0.711	-0.097	-3.725	-0.725	0.906	-1.649	1.679	-1.309
CAAR	-0.997	-0.056	-0.313	-0.787	-0.869	-3.569[a]	-3.870[a]	-3.011[a]	-4.219[a]	-2.848[c]	-3.956[b]
t-stat	-1.362	-0.055	-0.294	-0.581	-0.799	-3.907	-3.310	-2.880	-3.049	-1.910	-2.051
Panel C: Medium	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
AAR	-1.081[b]	0.648	-0.302	-0.333	0.042	-0.279	1.169	-0.575[b]	0.286	0.597[c]	0.439[c]
t-stat	-2.250	1.488	-0.975	-1.059	0.191	-0.481	1.635	-1.979	0.837	1.821	1.771
CAAR	-1.081[b]	-0.433	-0.734	-1.067	-1.025	-1.304	-0.134	-0.709	-0.423	0.174	0.613
t-stat	-2.250	-0.629	-1.127	-1.351	-1.321	-1.497	-0.106	-0.544	-0.326	0.130	0.428
Panel D: Low	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
AAR	-0.881[a]	0.309	-0.531	-0.121	0.249	-0.961	0.453	-0.084	1.235	0.269[c]	-0.714[c]
t-stat	-3.299	1.182	-1.512	-0.314	0.761	-1.504	1.388	-0.354	1.417	1.919	-1.952
CAAR	-0.881[a]	-0.572[c]	-1.103[b]	-1.224[c]	-0.975	-1.936[c]	-1.484	-1.568	-0.333	-0.064	-0.778
t-stat	-3.299	-1.645	-2.325	-1.795	-1.207	-1.932	-1.428	-1.564	-0.305	-0.058	-0.747

Note: t represents January 27, 2025 which is defined as the DeepSeek event day. AAR and CAAR are in percentage. [a, b] and [c] indicate 1%, 5% and 10% significance level, respectively.

Table 3. CAAR of the Three Industry Groups

Semiconductors											
Panel A: High	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
CAAR	-0.635	1.964	1.117	0.036	-3.567	-6.157[b]	-8.206[a]	-6.213[a]	-8.494[a]	-5.858[c]	-7.531[a]
Panel B: Medium	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
CAAR	1.511[a]	1.472[a]	1.401	0.734	-1.121	-4.201[a]	-5.623[a]	-3.926[a]	-3.838[a]	-3.695[a]	-4.006[a]
Panel C: Low	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
CAAR	1.351	0.905	1.499	1.332	0.795	-5.854	-7.434[c]	-6.268[c]	-5.318	-3.427	-4.512
Technology Hardware & Equipment											
Panel A: High	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
CAAR	-0.935	-1.108	-1.562	-2.962	-0.740	-6.171[b]	-7.544[a]	-6.794	-8.124[b]	-5.123	-5.665[c]
Panel B: Medium	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
CAAR	-1.552[b]	0.083	1.111	0.609	-0.091	-5.320[b]	-6.960[a]	-7.431[a]	-3.194	-1.814	-3.774
Panel C: Low	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
CAAR	-0.749[c]	-0.239	-0.448	-0.322	-0.323	-2.124	-2.024	-1.435	-0.267	-0.019	-1.309
Software & Services											
Panel A: High	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
CAAR	-1.151	-0.060	-0.193	-0.116	-0.293	-1.647	-1.194	-0.542	-1.577	-1.100	-2.297
Panel B: Medium	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
CAAR	-1.651[b]	-1.141	-1.803[b]	-2.168[b]	-1.594	0.474	3.275[c]	2.255	2.203	2.579	3.427
Panel C: Low	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
CAAR	-1.344[a]	-0.986[b]	-2.074[a]	-2.126[a]	-1.306	-0.268	1.036	0.287	0.255	0.194	0.397

Note: t represents January 27, 2025 which is defined as the DeepSeek event day. CAAR is in percentage. [a] , [b] and [c] indicate 1%, 5% and 10% significance level respectively. t-stat are not tabulated to conserve space. Stocks are sorted into three industry groups using their GICS codes. There are 43, 74 and 183 stocks in Semiconductors, Technology Hardware & Equipment and Software & Services respectively.

Table 4. Cross-Sectional Regression Results

CAR	[-5,0]	[-5,1]	[-5,2]	[-5,3]	[-5,4]	[-5,5]	[-1,1]	[0,1]	[0,2]	[0,3]	[0,4]	[0,5]
α	3.307	2.439	4.122	5.643	7.179	5.442	4.779	1.971	3.654	5.545	6.712	4.974
t-stat	0.897	0.483	0.755	0.983	1.256	0.957	0.955	0.473	0.738	1.011	1.161	0.877
High_sentiment	-1.677	-2.949[c]	-1.744	-3.616[b]	-2.972	-3.588[c]	-3.518[b]	-2.978[b]	-1.774	-3.646[b]	-3.002[c]	-3.617[c]
t-stat	-1.275	-1.747	-0.941	-1.97	-1.559	-1.658	-2.334	-2.262	-1.234	-2.421	-0.506	-1.893
MV	-0.349	-0.253	-0.443	-0.503	-0.678	-0.398	-0.441	-0.081	-0.261	-0.332	-0.346	-0.226
t-stat	-1.219	-0.739	-1.031	-1.208	-1.596	-1.02	-1.217	-0.315	-0.663	-0.812	-1.148	-0.57
Volatility	-3.756	-2.155	-3.173	-4.188	-3.022	-4.125	-1.624	-1.983	-3.001	-4.016	-2.85	-3.953
t-stat	-1.106	-0.386	-0.537	-0.714	-0.493	-0.574	-0.282	-0.396	-0.548	-0.727	-0.485	-0.569
Adj. R-squared	0.009	0.009	0.002	0.02	0.013	0.01	0.022	0.026	0.005	0.035	0.016	0.017
No. of observations	300	300	300	300	300	300	300	300	300	300	300	300

Note: The dependent variable is the CAR of the individual stocks over different event windows. The variable of interest is *High_sentiment,* which equals 1 if the stock belongs to the High sentiment group in Table 2, otherwise 0. *MV* represents the market equity value of the IT companies on the event day. *Liquidity* is proxied by the log value of the stock turnover by value on the event day, and *Volatility* is the historical 12-month stock price volatility. [a], [b] and [c] indicate 1%, 5% and 10% significance level,