

What do responses of financial markets to the collapse of FTX say about investor interest in cryptocurrencies? Event-study evidence

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Abstract

Studying the impact of the collapse of FTX on financial markets, we identify that, while this event was important to cryptocurrency markets, it was mostly irrelevant to traditional assets. Bitcoin, Ethereum, and Binance responded significantly negatively, while equity, energy, and currency markets were largely unmoved. Gold and silver having significant positive returns suggest cryptocurrency investors fled to purported safe-havens. Results are consistent with traditional investors already having evolved to indifference to cryptocurrencies during the bear market prior to the FTX collapse. Results also suggest that cryptocurrencies are likely not as important a concern to financial stability as previously regarded.

Keywords: FTX; Cryptocurrencies; Financial market risk; Event studies

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1 Introduction and motivation

Previous research suggests that equity markets are vulnerable to spillovers from cryptocurrency markets (Dai, Goodell, Huynh, Liu, and Corbet, 2022; Goodell and Goutte, 2021). Much of these studies were undertaken during a long upward trend in cryptocurrency markets, much of which during a time when the global economy was challenged by COVID-19 restrictions. As a result, academics and policymakers have reasonably become concerned that as the cryptocurrency investor base evolves into deeper penetration into individual investor base with increasingly sensitive fluctuating impacts of investor movement (Karaa et al., 2021), the equity market and other markets will become more vulnerable to dangerous spillovers. The considerable attention to the FTX collapse provides an ideal natural experiment to investigate this further.

This paper contributes to the literature by examining how the collapse of FTX affected the markets for equities (representing the general business environment), fiat currency (a close substitute for cryptocurrencies), cryptocurrencies, including stablecoins (for studying the impact across the industry), and precious metals and energy (being the safe-haven assets). To the best of our knowledge, this is the first paper that examines the impact of the collapse of FTX on the global financial markets. The previous literature has explored the impact of the collapse of firms at different times on the financial markets (Bouzzine and Lueg, 2020; Ceylan, 2021; Corbet and Goodell, 2022; and Goodell, Li, and Liu, 2023). This paper contributes to the literature by studying the impact of the collapse of FTX on other financial markets. FTX has been the third-largest cryptocurrency exchange in the world by volume, making its collapse crucial to the general stability of the global financial markets. Furthermore, we looked at the impact of the overall unobservable stress on the financial markets during a period of uncertainty rather than concentrating on particular news surrounding the collapse of FTX using the standard event-study approach (MacKinlay, 1997). This analysis allows us to conduct a comprehensive examination of the effect of the fall of FTX on the global financial markets.

We use standard (MacKinlay, 1997) event methodology techniques to investigate the impact of the collapse of FTX on the financial markets (stocks, fiat currency, cryptocurrencies, metals, and energy). Using the market model, we compute the predicted returns, which we then use to calculate abnormal returns. Additionally, we sum the abnormal returns across the event window to get cumulative abnormal returns, and we average the abnormal returns throughout the event window to determine aggregate abnormal returns. We statistically test for the significance of abnormal returns, cumulative abnormal returns, aggregate abnormal returns, and cumulative abnormal returns. We define an event window of 12 days between $t-4$ and $t+7$ days and an estimation window of 235 days between $t-239$ and $t-5$ days. We use data for estimation between November 28, 2021, and November 17, 2022.

Results show insignificant abnormal returns for the stock markets, fiat currencies, stablecoins, and all precious metals except gold. Abnormal returns are also significant in the case of Bitcoin and Ethereum. Gold shows positive abnormal returns, consistent with some investors seeking safe havens. Regarding cumulative abnormal returns, we also find insignificant CARs for stock markets, fiat currencies (except JPY/USD), stablecoins, palladium, platinum, and energy markets (Brent and WTI). However, Bitcoin, Ethereum, Binance coin, gold, and silver show significant CARs. The aggregate AARs are negatively significant on the event day and the subsequent day, whereas the aggregate CAARs are positively significant on two days and one day before the event.

Studying the impact of the collapse of FTX on financial markets, we identify that, while this event was important to cryptocurrency markets, as indicated by large reactions of cryptocurrencies, it was mostly irrelevant to traditional assets, as gauged by a little reaction from equities and other traditional assets. Bitcoin, Ethereum, and Binance responded significantly negatively, while equity, energy, and currency markets were largely unmoved. Gold and silver having significant positive returns suggest cryptocurrency investors fleeing to purported safe-havens. Traditional investors (equities and traditional assets) not only ignored the FTX collapse but also ignored the ensuing broad decline in cryptocurrencies. Results are consistent with traditional investors already having evolved to indifference to cryptocurrencies during the bear market prior to the FTX collapse (Khalfaoui, Gozgor, and Goodell, 2022). Results suggest that cryptocurrencies are likely not as significant a concern to financial stability as previously regarded.

The rest of the paper is structured as follows: Section 2 provides background and the literature's context. Section 3 describes the data and methodology. Section 4 provides results and discussion, while Section 5 concludes.

2 Background and literature

2.1 FTX details

FTX (Futures Exchange) was the third-largest cryptocurrency exchange by volume as of July 2021 with over a million members (Reuters, 2021). However, the FTX token (FTT) crashed on November 08, 2022, and subsequently, FTX filed for bankruptcy. The crisis started on November 2, 2022, when CoinDesk published an exclusive report on the critical balance sheet information about Alameda Research (an affiliate of the FTX). This revealed that Alameda Research had a sizable investment in the FTT, and the stake would be challenging to sell at the present price. The CEO of Binance, Changpeng Zhao, also announced that he would sell his FTT holdings. The price of the FTT then dropped abruptly. In between, Binance also announced a non-binding letter of intent to purchase FTX, subject to due diligence, quelling the fear in the

market. However, Binance canceled the FTX transaction on the following day. The Bahamian regulator also froze the assets of FTX and FTX filed for bankruptcy on November 11, 2022, in the US¹.

2.2 Literature of reputational contagion

Literature has explored the contagion of firm-level stress events on other related firms and industries. For example, Ceylan (2021); Dumontaux and Pop (2013); Hamilton and Micklethwait (2016); Kim et al. (2015) (Lehman Brothers). Bouzzine and Lueg (2020) (Volkswagen Dieselgate scandal). Corbet and Goodell (2022); Goodell and Corbet (2023) (Colonial Pipeline ransomware attack); Corbet, Goodell, and Günay, 2020 (West Text Intermediate oil negative prices); Goodell, Li, and Liu (2023) (Kangmei Pharmaceutical). These papers explore how significant financial and reputational events to one firm's spillover to other firms that have connections to the impacted firm or simply unconnected firms in the same industry (Corbet and Goodell, 2022) or competing sources of energy (Corbet, Goodell, and Günay, 2020).²

3 Data and methodology

3.1 Data

We use daily data for stocks of the USA, Germany, France, UK, Italy, Japan, Canada, and China, fiat currency (GBP/USD, EUR/USD, JPY/USD, CAD/USD, CNY/USD), as well as cryptocurrencies Bitcoin (BTC), Ethereum (ETH), Tether (USDT), Binance Coin (BNB), USD Coin (USDC), metals (Gold, Silver, Palladium, Platinum), and energy (Brent, WTI, Natural Gas, Heating Oil). Price data of financial markets are from *investing.com*.

The event day is November 08, 2022, when the price of FTX's associated token FTT falls below \$6 from \$25.50 (November 02, 2022). Figure 1 shows the average change in prices in each financial market. We use a 235-day estimation window, i.e., from t-239 to t-5. We define a 12-working days event window from t-4 (November 02, 2022) to t+7 (November 17, 2022).

[Insert Figure 1 here]

3.2 Methodology

Following Dyckman et al. (1984), we use the OLS market model to estimate the normal returns. Using Equation 1, we get the expected or normal return, $E(R_{it})$, for the asset i at time t :

$$E(R_{it}) = a_i + b_i R_{mt} \quad (1)$$

¹ Please refer to Young and Keoun (2022) to study the crises' chronology of events.

² See Cole et al., (2021) and Toms (2019) for overviews of corporate scandals.

Where R_{mt} stands for the benchmark MSCI world equity index returns on day t . Additionally, we employ the method below to determine the benchmark index's and the sample indices' actual daily returns:

$$R_{it} = [(P_{it} - P_{it-1})/P_{it-1}] \times 100 \quad (2)$$

Where, R_{it} represents the return of the chosen index i on day t , whereas P_{it} and P_{it-1} display the price of the chosen index i on day t and the day prior to day t , respectively.

3.2.1 Abnormal and Cumulative abnormal returns

By comparing actual returns with estimated daily returns, we determine the abnormal returns. Equation 3 is used to compute the abnormal return, AR_{it} , for index i on day t :

$$AR_{it} = R_{it} - E(R_{it}) \quad (3)$$

Where R_{it} presents the actual returns on the asset i on day t . we subtract expected returns from actual returns in equation (3) to get abnormal returns (AR_{it}) for index i on day t . Over the event window from the day r_1 to r_2 , we estimate the cumulative abnormal return (CARs) for asset i as follows:

$$CAR_i(r_1, r_2) = \sum_{t=r_1}^{r_2} AR_{it} \quad (4)$$

3.2.2 Aggregate of Abnormal and Cumulative Aggregate of Abnormal Returns

We further estimate the aggregate abnormal returns by summing daily abnormal returns for each market to study the aggregate response of financial markets to the collapse of FTX. Aggregate abnormal returns are a sum of the abnormal returns from N markets as follows:

$$AAR_t = \frac{1}{N} \sum_{i=1}^N AR_{it} \quad (5)$$

Where AAR_t represents the average abnormal returns across the markets at time t , N is the number of markets included in the study. Finally, we estimate cumulative average abnormal returns (CAARs) from AAR_t for the event window.

4 Results

Table 1 presents the abnormal returns on the event day for stock markets (Panel A), fiat currencies (Panel B), cryptocurrencies (Panel C), and precious metals and energy markets (Panel D).

Panel A shows insignificant abnormal returns for all stock markets included in this study. Panel B also shows insignificant abnormal returns for the various pairs of fiat currencies. However, abnormal returns are significant at 1 % for Bitcoin and Ethereum as shown in Panel C of Table 1. Abnormal returns are -11.24% for BTC and -16.80% for ETH. From Panel D, the abnormal returns are also significant in the case of gold (2.085%), and natural gas (-3.586%) at a 5% level. The positive abnormal return on gold shows the safe haven properties of gold (Salisu et al., 2021). Results are consistent with cryptocurrency investors fleeing cryptocurrencies to supposed safe-haven metals following the FTX collapse.

[Table 1 about here]

To examine how the FTX collapse affected various markets, we also compute cumulative abnormal returns (CAR) at the market level. Table 2 presents the CARs of the global stock markets for a period from $t-4$ to $t+7$. The stock markets do not show any significant impact of the FTX collapse, except for the Chinese stock market. The impact on the Chinese market is positive (3.704% and 3.882%) and significant at 10%, for one and two days before the event, respectively.

[Insert Table 2 here]

Table 3 presents the results for the CARs on fiat currencies (Panel A), and cryptocurrencies (Panel B). An exception for the fiat currencies, JPY/USD shows significant CAR following the event after $t+2$ days. All other currencies are unresponsive. The CARs are significant at 1 % for $t+2$ and $t+3$ days with a magnitude of 5.73% and 7.343%, respectively. They are positive and significant at 5% after $t+2$ days. Across all markets, cryptocurrencies are the most affected markets. Panel B of Table 3 shows that BNB is the only cryptocurrency that manifests significant CAR before the FTX collapse, with a CAR of 11.166%, significant at 5%.

As is generally known, leaked financial records of Alameda Research on November 02, 2022, led to regulatory scrutiny with Binance CEO Changpeng Zhao concomitantly announcing a sell-off of substantial holdings of FTX coin on November 06, 2022 (Young and Keoun, 2022). The negative CAR we find for Binance before the event day is attributable to this tension between Binance and FTX. We find that post-event, all the cryptocurrencies (including BNB) consistently show negatively significant CARs except stablecoins. Stablecoins, USDT, and USDC were not influenced by the collapse. However, ETH shows the highest negative returns followed by BTC and BNB. ETH has shown a CAR of -30.232% on $t+1$ which is significant at the 1% level. Other coins like BTC and BNN show a CAR of -20.901% and -15.511% on $t+1$ and significant at 1 % level, respectively. The magnitude of after-event CARs decreases over time; however, the highest negative CAR (-32.145%) is observed on ETH on $t+6$, significant at 5%.

[Insert Table 3 here]

CARs for the precious metals and energy markets are presented in Table 4. Panel A shows the CARs for precious metals, while Panel B displays the CARs for energy markets. Examining Panel A, CARs are positive on the metal markets. , Silver is the only metal that has shown significant CARs (at 5% level) before the event on $t-2$ (i.e., 6.175%) and $t-1$ (i.e., 6.49%) day of the event. CARs on silver also remain significant after the event until $t+4$. After the $t+2$, gold consistently shows significant positive CARs.

Palladium and platinum do not show any significant CARS during the event window. We attribute results for metals to cryptocurrency investors moving from cryptocurrencies to purported metal safe-havens.³ However, results for equities do not support traditional equity investors undertaking a similar flight. Results are consistent with a separation of responses for cryptocurrency versus equity investors.⁴

Panel B of Table 4 demonstrates the CAR of energy markets. In general, the energy market also does not meaningfully react to the collapse of FTX. CARs on Brent and WTI are insignificant throughout the event window. However, natural gas and heating oil show significant CARs before the event. Natural Gas has a CAR of 10.543% on t-4, 12.132% on t-2, and 19.587% on the t-1 day, significant at 1%, 10%, and 1%, respectively. Heating oil has significant CAR (of 6.892%) at 10%, on the t-3 period. Overall, however, energy markets do not appear to have been meaningfully reactive to the FTX collapse.

[Insert Table 4 here]

Table 5 shows the aggregate AARs and CAARs with the t-statistics for all the markets. It shows a positive aggregate AAR for all the markets on t-2 (i.e., 1.856%) significant at 1%; however, the aggregate AAR turns negative and significant at 10% on event day and at 5% on the following day with a magnitude of -1.7% and -2.085%, respectively. Aggregate CAARs are also positively significant before the event but insignificant in the post-event period. The aggregate CAARs are 2.958% and 2.416% on t-2 and t-1 significant at 5% and 10%, respectively. Afterward, all CAARs are insignificant.

[Insert Table 5 here]

In summary, the collapse of FTX resulted in negative returns for cryptocurrency markets, while other financial markets largely ignored the event. This suggests that traditional investors not only ignored the FTX collapse but also ignored the ensuing broad decline in cryptocurrencies.

5 Conclusions

Previous research suggests that equity markets are vulnerable to spillovers from cryptocurrency markets (co-crash; goutte). Much of these studies were undertaken during a long upward trend in cryptocurrency markets, much of which during a time when the global economy was challenged by COVID-19 restrictions. As a result, academics and policymakers have reasonably become concerned that as the cryptocurrency investor base evolves into deeper penetration into individual investor base (cite

³ See Salisu et al., 2021 for reaction of gold during COVID-19.

⁴ Metals markets are typically significantly affected during crisis periods, as highlighted, for example, by Umar et al. (2022) for the Russian-Ukraine war crisis.

paper), and, perhaps becomes more sensitive to fluctuating impacts of investor attention (CITES), that equity market and other markets will become more vulnerable to dangerous spillovers. The considerable attention to the FTX collapse provides an ideal natural experiment to investigate this further.

Studying the impact of the collapse of FTX on financial markets, we identify that, while this event was important to cryptocurrency markets, it was mostly irrelevant to traditional assets. Bitcoin, Ethereum, and Binance responded significantly negatively, while equity, energy, and currency markets were largely unmoved. Gold and silver having significant positive returns suggest cryptocurrency investors fleeing to purported safe-havens. Results are consistent with traditional investors already having evolved to indifference to cryptocurrencies during the bear market prior to the FTX collapse. Results also suggest that cryptocurrencies are likely not as important a concern to financial stability as previously regarded.

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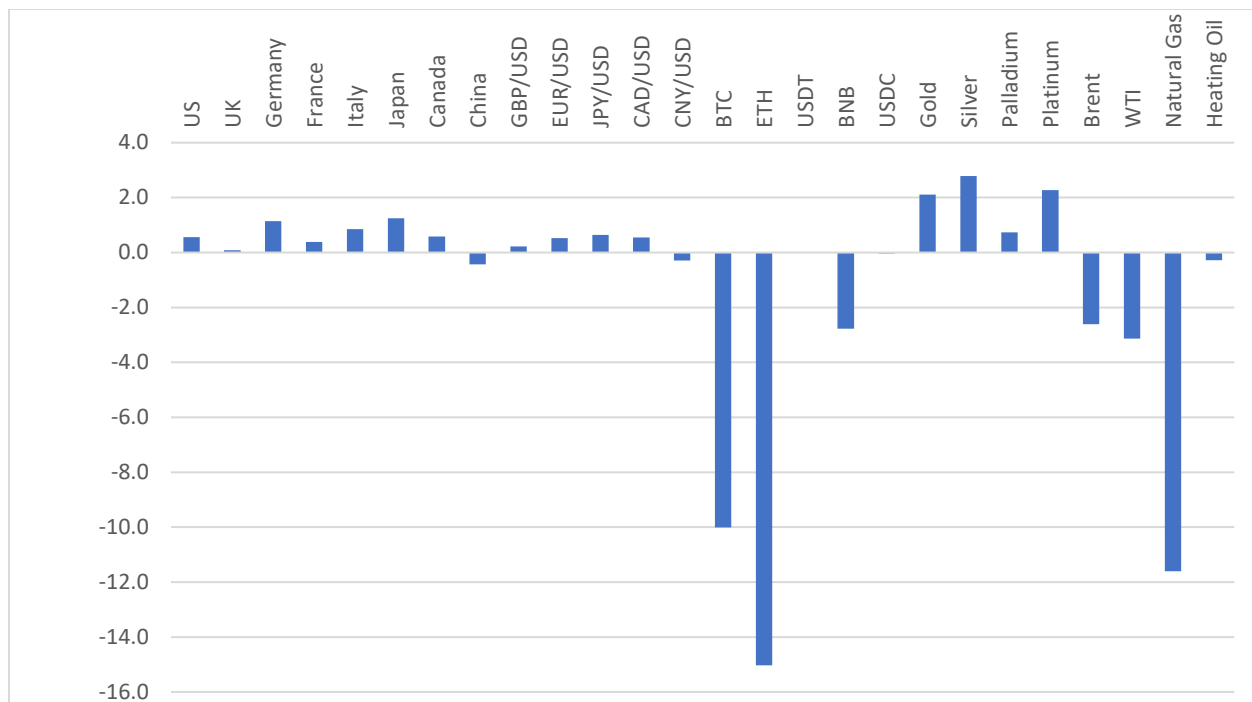


Figure 1. Average change in prices on the event day in financial markets

Table 1. Abnormal returns on the event day

	AR	$t\ stat_{AR}$		AR	$t\ stat_{AR}$
Panel A. Stock markets			Panel C. Cryptocurrencies		
US	-0.387	-0.817	BTC	-11.240***	-3.437
UK	-0.376	-0.434	ETH	-16.798***	-3.767
Germany	0.475	0.415	USDT	-0.010	-0.243
France	-0.284	-0.261	BNB	-4.096	-1.074
Italy	0.172	0.136	USDC	-0.034	-0.798
Japan	0.879	0.649			
Canada	-0.022	-0.042	Panel D. Precious Metals & Energy		
China	-0.451	-0.388	Gold	2.085**	2.253
Panel B. Fiat Currencies			Silver	2.552	1.314
GBP/USD	-0.006	-0.010	Palladium	0.252	0.075
EUR/USD	0.362	0.704	Platinum	1.843	0.966
JPY/USD	0.722	1.181	Brent	-2.996	-1.020
CAD/USD	0.326	0.896	WTI	-3.586	-1.414
CNY/USD	-0.293	-0.982	Natural Gas	-12.432**	-2.420
			Heating Oil	-0.852	-0.214

US-United States, UK-United Kingdom, BTC-Bitcoin, ETH-Ethereum, USDT-Tether, USDC-USD coin, WTI-West Texas Intermediate. ***, **, * indicate the level of significance at 1%, 5%, and 10%, respectively.

Table 2. Cumulative abnormal returns (CAR) of stock markets

	US	UK	Germany	France	Italy	Japan	Canada	China
t-4	-0.698 (-0.514)	0.171 (0.150)	0.657 (0.478)	0.384 (0.287)	1.318 (0.922)	0.575 (0.430)	-0.119 (-0.106)	1.375 (1.154)
t-3	-0.289 (-0.150)	1.403 (0.867)	0.737 (0.379)	0.817 (0.432)	1.938 (0.959)	0.593 (0.314)	0.600 (0.377)	1.384 (0.822)
t-2	-0.974 (-0.413)	2.490 (1.257)	1.799 (0.755)	2.172 (0.938)	3.005 (1.214)	-1.371 (-0.592)	0.388 (0.199)	3.704* (1.795)
t-1	-1.321 (-0.486)	1.395 (0.610)	1.419 (0.516)	1.257 (0.470)	2.965 (1.037)	-0.670 (-0.251)	0.048 (0.021)	3.882* (1.630)
t+1	-1.987 (-0.597)	1.638 (0.585)	2.999 (0.891)	1.997 (0.610)	4.783 (1.366)	0.280 (0.086)	-0.470 (-0.170)	3.122 (1.070)
t+2	-1.582 (-0.440)	0.408 (0.135)	2.875 (0.790)	0.442 (0.125)	3.677 (0.973)	-2.597 (-0.734)	-0.363 (-0.122)	2.340 (0.743)
t+3	-2.807 (-0.730)	-1.361 (-0.421)	1.910 (0.491)	-0.471 (-0.124)	2.382 (0.589)	-0.429 (-0.113)	-1.118 (-0.351)	3.901 (1.158)
t+4	-3.007 (-0.737)	-0.178 (-0.052)	3.020 (0.732)	0.193 (0.048)	3.451 (0.805)	-1.264 (-0.315)	-1.641 (-0.486)	3.901 (1.092)
t+5	-3.404 (-0.792)	-0.993 (-0.275)	2.576 (0.593)	-0.205 (-0.049)	2.955 (0.654)	-1.658 (-0.392)	-2.084 (-0.585)	5.498 (1.460)
t+6	-3.378 (-0.749)	-0.906 (-0.239)	2.171 (0.476)	-0.174 (-0.039)	2.877 (0.607)	-1.238 (-0.279)	-1.750 (-0.468)	5.189 (1.314)
t+7	-2.968 (-0.630)	-0.692 (-0.175)	2.904 (0.610)	-0.185 (-0.040)	2.605 (0.526)	-1.351 (-0.292)	-1.681 (-0.431)	5.171 (1.253)

***, **, * indicate the level of significance at 1%, 5%, and 10%, respectively, and t-stats are in brackets.

Table 3. Cumulative abnormal returns (CAR) of fiat and crypto currencies

	Panel A. Fiat currencies					Panel B. Cryptocurrencies				
	GBP/ USD	EUR/ USD	JPY/ USD	CAD/ USD	CNY/ USD	BTC	ETH	USDT	BNB	USDC
t-4	-0.274 (-0.276)	-0.142 (0.148)	0.412 (0.429)	-0.124 (-0.133)	0.084 (0.095)	1.496 (0.511)	0.026 (0.007)	0.015 (0.017)	1.393 (0.436)	0.006 (0.007)
t-3	-1.789 (-1.274)	-0.452 (0.334)	0.338 (0.248)	0.007 (0.006)	0.003 (0.003)	4.308 (1.041)	3.948 (0.725)	0.022 (0.018)	6.642 (1.470)	0.003 (0.003)
t-2	-0.439 (-0.255)	1.283 (0.774)	1.502 (0.903)	1.484 (0.921)	1.542 (1.006)	5.983 (1.180)	7.358 (1.104)	0.020 (0.014)	11.166** (2.018)	0.000 (0.000)
t-1	0.433 (0.218)	1.629 (0.852)	1.550 (0.807)	1.004 (0.540)	0.942 (0.532)	1.606 (0.274)	0.204 (0.026)	0.016 (0.010)	4.391 (0.687)	0.028 (0.016)
t+1	-0.589 (-0.242)	1.820 (0.777)	1.922 (0.817)	1.053 (0.462)	0.951 (0.439)	-20.901*** (-2.916)	-30.232*** (-3.207)	-0.129 (-0.062)	-15.511* (-1.983)	0.030 (0.014)
t+2	1.160 (0.442)	2.703 (1.068)	5.730** (2.255)	1.303 (0.529)	1.425 (0.609)	-17.982** (-2.323)	-22.412** (-2.201)	-0.228 (-0.100)	-9.129 (-1.080)	0.063 (0.028)
t+3	1.643 (0.585)	3.683 (1.361)	7.343** (2.703)	1.267 (0.482)	2.429 (0.970)	-24.247*** (-2.929)	-27.567** (-2.533)	-0.198 (-0.082)	-16.935* (-1.874)	0.066 (0.027)
t+4	1.177 (0.395)	3.615 (1.259)	6.701** (2.325)	1.014 (0.363)	3.019 (1.137)	-25.344*** (-2.887)	-29.541** (-2.559)	-0.116 (-0.045)	-19.704** (-2.056)	0.052 (0.020)
t+5	1.766 (0.562)	3.600 (1.190)	7.185** (2.366)	0.945 (0.321)	3.421 (1.222)	-25.480*** (-2.754)	-31.147** (-2.559)	-0.110 (-0.040)	-22.123** (-2.190)	0.027 (0.010)
t+6	2.467 (0.749)	4.252 (1.340)	7.145** (2.243)	0.810 (0.263)	2.888 (0.984)	-25.163*** (-2.593)	-32.145** (-2.518)	-0.096 (-0.034)	-22.511** (-2.124)	0.012 (0.004)
t+7	2.323 (0.675)	4.142 (1.250)	6.820** (2.050)	1.014 (0.315)	2.060 (0.672)	-23.670** (-2.335)	-31.740** (-2.381)	-0.076 (-0.025)	-22.896** (-2.069)	0.009 (0.003)

***, **, * indicate the level of significance at 1%, 5%, and 10%, respectively, and t-stats are in brackets.

Table 4. Cumulative abnormal returns (CAR) of precious metals and energy markets

	Panel A. Precious Metals				Panel B. Energy Markets			
	Gold	Silver	Palladium	Platinum	Brent	WTI	Natural Gas	Heating Oil
t-4	0.145 (0.135)	0.151 (0.092)	-0.816 (-0.321)	0.751 (0.455)	1.831 (0.810)	2.177 (1.084)	10.543*** (2.788)	1.713 (0.579)
t-3	-0.904 (-0.592)	-0.256 (-0.110)	-3.143 (-0.874)	-1.497 (-0.641)	0.443 (0.139)	0.382 (0.134)	6.512 (1.218)	6.892* (1.647)
t-2	1.809 (0.967)	6.175** (2.173)	-1.768 (-0.401)	1.547 (0.541)	3.934 (1.005)	4.657 (1.338)	12.132* (1.853)	7.302 (1.425)
t-1	1.993 (0.923)	6.490** (1.978)	0.754 (0.148)	3.969 (1.202)	2.812 (0.622)	3.221 (0.801)	19.587*** (2.590)	3.213 (0.543)
t+1	4.071 (1.539)	8.749** (2.177)	-1.071 (-0.172)	5.151 (1.274)	-2.790 (-0.504)	-3.497 (-0.710)	3.554 (0.384)	-0.515 (-0.071)
t+2	6.141** (2.149)	9.118** (2.100)	2.081 (0.309)	7.867* (1.801)	-3.011 (-0.504)	-4.391 (-0.826)	6.556 (0.655)	-4.589 (-0.586)
t+3	6.941** (2.272)	8.391* (1.808)	5.312 (0.738)	6.714 (1.438)	-1.185 (-0.185)	-2.301 (-0.405)	-0.770 (-0.072)	-5.882 (-0.703)
t+4	7.429** (2.293)	10.666** (2.167)	5.397 (0.707)	5.837 (1.178)	-4.167 (-0.615)	-5.756 (-0.955)	0.322 (0.028)	-6.338 (-0.714)
t+5	7.378** (2.160)	7.652 (1.475)	6.685 (0.831)	4.241 (0.812)	-3.848 (-0.538)	-5.073 (-0.798)	1.005 (0.084)	-4.255 (-0.455)
t+6	7.395** (2.065)	7.940 (1.459)	7.065 (0.837)	3.947 (0.721)	-4.891 (-0.652)	-6.541 (-0.981)	4.025 (0.321)	-5.111 (-0.521)
t+7	6.741* (1.802)	5.613 (0.988)	3.822 (0.434)	1.775 (0.310)	-8.214 (-1.049)	-11.130 (-1.599)	6.939 (0.530)	-7.700 (-0.751)

***, **, * indicate the level of significance at 1%, 5%, and 10%, respectively, and t-stats are in brackets.

Table 5. Aggregate AARs and CAARs of all markets

Days	AAR	AAR _{t stat}	CAAR	CAAR _{t stat}
t-4	0.887	1.244	0.887	1.244
t-3	0.215	0.302	1.102	1.093
t-2	1.856***	2.605	2.958**	2.396
t-1	-0.542	-0.760	2.416*	1.695
0	-1.700*	-2.386	0.716	0.449
t+1	-2.085**	-2.925	-1.368	-0.784
t+2	0.892	1.251	-0.477	-0.253
t+3	-0.804	-1.128	-1.280	-0.635
t+4	-0.307	-0.430	-1.587	-0.742
t+5	-0.161	-0.226	-1.748	-0.776
t+6	-0.011	-0.015	-1.759	-0.744
t+7	-0.563	-0.790	-2.322	-0.941

***, **, * indicate the level of significance at 1%, 5%, and 10%, respectively.