Bankacılık ve Finansal Araştırmalar Dergisi, 2025; 12(2), 97-104
Journal of Banking and Financial Research 2025; 12(2), 97-104
DOI: https://doi.org/10.55026/jobaf.1601072

Araştırma Makalesi / Research Article

Interpreting Market Behavior: Price Bubbles in the Non-Metallic Mineral Sector Following an Earthquake [1]

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Gönderim Tarihi	Kabul Tarihi
17/12/2024	09/07/2025

Önerilen Atıf / Suggested Citation: Öncü, E. & Gündüz, V. & Erdoğan, A. (2025). Interpreting Market Behavior: Price Bubbles in the Non-Metallic Mineral Sector Following an Earthquake, *Bankacılık ve Finansal Araştırmalar Dergisi*, 12(2), 97-104.

Abstract

Market share prices may be impacted by unforeseen circumstances. Unexpected occurrences may have a greater impact on some industries than others. The building industry is also quickly impacted by earthquake disasters. Labor-intensive companies in the stone and soil-based sector will be able to provide themselves a competitive edge with fewer variables under more competitive circumstances. Another major risk to the sector is the potential for a major earthquake with catastrophic effects. Sector-specific impacts could also vary. In the event of an earthquake, for instance, the building industry may benefit while other industries would suffer. The effects of the earthquake that struck on February 6 in this specific setting were examined in this study. The Borsa Istanbul (BIST) Stone and Soil Based Industry Index was used to track the effects of the 2023 earthquake using data from 16.06.2022 to 15.03.2024. The GSADF test revealed ten distinct price bubbles between 2022 and 2024 as a result of the earthquake and other factors.

Keywords*: GSADF, Earthquake, Price Bubbles.*

1. Introduction

Natural catastrophes have drawn human interest and attention throughout human history because they have occurred as remarkable events in various parts of the planet at different times. The primary cause of this is the severe issues these natural catastrophes create, which result in significant losses in terms of both human life and property. The interest in natural catastrophes has grown due to the proliferation of printed and visual mass media, as well as the knowledge that disasters can occur anywhere in the world. However, with the influence of globalization, the economic and social effects of a disaster occurring in a different part of the world can go beyond the borders of the country and affect people who continue their lives in far-away countries that seem unrelated to the incident (Avdar and Avdar, 2022).

[1]This is the revised and edited version of the paper presented at the ICBFB 2024.

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Throughout history, people have been fascinated by natural calamities, which have occurred as remarkable movements in various parts of the world at different times. The primary factor underlying this association is the grave implications that natural disasters have on people, including the loss of life and property. The fact that disasters in one region of the world are known about and followed by people in another has further raised interest in these events due to the growth of written and spoken mass media. Globalization, on the other hand, has made it possible for the economic ramifications of a disaster anywhere in the globe to transcend national boundaries and have an impact on people living in distant nations (Akar, 2013).

Following a classification of the costs associated with natural catastrophes, these elements are Direct costs, indirect costs, and secondary costs make up the three primary categories. All fixed and fixed assets, completed and semi-finished manufacturing commodities in capital and inventories, and raw materials incur direct costs. These costs are coordinated. Furthermore, Akar (2013) states that direct costs also include the expenditures associated with emergency relief and rescue operations.

The direct costs, which make up a sizable portion of the overall cost, include the expenses incurred during the disaster response process, the physical damage sustained following the event, and the costs associated with reconstructing the affected region. Compared to other expenditures, direct costs are easier to assess. Natural disaster-related devastation and damage, manufacturing disruptions, a decline in sales, etc. are all examples of indirect costs. It pays for the expenses associated with such circumstances. It is not as simple to quantify as direct expenses since the calculation procedure entails more intricate and technical steps (Şen, 2023).

By way of illustration, 23% of Turkey's population lived in the Marmara Earthquake's effective zone. Six percent of the overall population was among those most severely damaged and killed by the earthquake (Altun, 2018). The Gross National Product (GNP) and industrial added value (IAV) of the seven earthquake-affected provinces were 34.7% and 46.7% respectively. According to DPT (1999), the provinces of Kocaeli, Sakarya, and Yalova—which were designated as seismic zones and suffered significant damage from the earthquake—accounted for 6.3% of the GNP and 13.1% of IAV.

Table 1. The Marmara Earthquake's Costs in Billions of Dollars

Costs	TUSIAD	WORLD BANK
Direct Costs	10	3,1-6,5
Accommodation	4	1,1-3
Businesses	4,5	1,1-2,6
Facilities	1,5	0,9
Indirect Costs	2,8	1,8-2,6
Loss of value addition	2	1,2-2
Expenses for emergency aid	0,8	0,6
Total (rounded) cost of damage	13	5-9
Secondary Effects		
Fiscal costs	2	3,6-4,6
Employment losses (as a percentage of the region's labor force)	-	20 to 50 percent

An analysis of the economic impacts of the 1999 Marmara Earthquake was carried out by the Organization for Economic Co-operation and Development (OECD). The economic impacts of the earthquake are broken down into

three categories in this study: direct, indirect costs, and secondary costs. While the consequences of the earthquake on inventories and capital goods are considered direct costs, other costs include lost revenue and output as well as expenditures associated with emergency assistance. The impacts of the earthquake on financial policies and metrics including the balance of payments, inflation, and unemployment are reflected in secondary costs (Altun, 2018).

On February 6, 2023, at 04:17, a 7.7-magnitude earthquake occurred in the Pazarcık district of Kahramanmaraş province. The same day, at 13:24, another 7.6-magnitude earthquake happened in the Elbistan district of Kahramanmaraş province. The aforementioned earthquakes caused massive damage in 11 provinces, namely Adana, Adıyaman, Diyarbakır, Elazığ, Gaziantep, Hatay, Kahramanmaraş, Kilis, Malatya, Osmaniye, and Şanlıurfa. However, the adjacent provinces were also affected (Şen, 2023).

Given the extent of the earthquake's devastation and Turkey's requirements for growth and building, it will take five years to rebuild the area. The amount of buildings that need to be rebuilt exceeds Turkey's and the region's yearly construction capabilities. 1.4 million independent units in the earthquake zone are mildly damaged, 170,000 units are moderately damaged, and 650 thousand units are completely destroyed or urgently need to be demolished. The building occupancy permit received in 2022 states that the number of units is around seven times that of houses. Additionally, it exceeds the building occupancy permits granted nationwide in Turkey in 2022. It is believed that the damage caused by the earthquake cannot be repaired in a single year due to the continued need for housing in Turkey as well as the reinforcing and repair efforts of other structures destroyed in the earthquake.

2. BIST's Safety Precaution

Following a 16.2% decline on the third trading day following the earthquake on February 6, BIST was shut down to new transactions. Investors in stocks expressed disapproval about the non-cancellation of transactions from the previous two days. The primary issue stems from the belief that the opening of the stock market violates the "Equal transaction principle" outlined in Article 357 of the Turkish Commercial Law (TTK) in light of the realities in the earthquake zone (Şen, 2023).

The BIST share markets will be temporarily suspended as of February 6, 2023, per the Board Decision made by SPK in response to the nighttime earthquake (Şen, 2023). This is being done to protect investors' rights and interests and to ensure that the capital markets function in a transparent, stable, and dependable manner (SPK, 2023);

- Outlawing transactions involving short sales and alerting investors and investment firms to the fact that positions taken during the day without using the short sale button and closed the same day are likewise prohibited.
- Putting in place a warehouse requirement before investors may sell shares,
- Investors who own shares: it has been determined that only investment institutions holding the appropriate assets are authorized to sell the securities in question.

Precautionst taken by Borsa Istanbul Management (Borsa Istanbul, 2023):

- Reducing the order processing ratio from 15:1 to 5:1 in the equity market and raising the threshold value exceedance fee from 0.03 kuruş to 0.25 kuruş
- In all capital market instruments whose opening session is applied in the equity market and in all contracts traded in VIOP
- Prohibiting order cancellation, price worsening, and quantity reduction in the opening session
- There will be a 20% rise in the order cancellation, price deterioration, and amount reduction cost items. Additionally, the voluntary order cancellation fee, which is applied as 1 in 100,000 in VIOP, will increase by 20% and be calculated as 1.2 in 100,000. The session end time of option contracts will be shortened by 5 minutes to 18.10 on full working days and 12.40 on half working days. Additionally, a new index on companies that make buybacks will be calculated. Lastly, all current measures based on investment instruments that are being carried out as part of our Stock Exchange's surveillance activities will be abolished.

3. Literature Review

The present value of the company's anticipated future free cash flows, discounted at a certain rate of return, is its firm value. Events that impact human existence and the economy have an impact on businesses' earnings and, consequently, their cash flows in the future. Events like floods, earthquakes, and wars have an impact on businesses. Numerous research have looked at how the Covid-19 epidemic has affected financial markets, particularly in recent times (Oncu, 2022). The effects of numerous events on the stock prices of firms were explored in the literature review.

In Liew (2020) research, a case study was used to analyze the returns of 21 tourism stocks that were traded on the Shanghai and Shenzhen stock exchanges between March 11, 2019 and April 14, 2020. Following the Wuhan quarantine, 18 out of 21 tourism equities traded on Chinese stock exchanges showed statistically significant negative cumulative anomalous returns. Prices of shares dropped 20%. Another study found that, when examining the stock returns of firms involved in vaccination trials, positive anomalous returns were noted in the post-Covid-19 era (Oncu, 2021).

In another study applying the case study method, Chowdhury (2020) examined the impact of Covid-19 on the tourism industry in Bangladesh. According to the data between January and March, companies have significantly negative cumulative abnormal returns in the post-pandemic period. While travel restrictions and quarantines negatively affected stock returns, the number of cases had a positive effect for Bangladesh.

In the study by Abu Bakar and Rosbi (2020), the Covid-19 effect was assessed and economic shifts in the tourism sector were identified using the supply and demand curve. The results suggest that the public's fear of the pandemic may have contributed to the fall in demand for travel-related services. Panic results from the current situation's quarantine strategy and the disease's spread. Panic is followed by a reality of lower customer demand. The authors therefore propose that the price of the tourism industry will continue to decline in tandem with the decline in demand, in accordance with the market equilibrium of the supply-demand theory.

The anomalous return rates of 176 travel agencies that operated in the USA in February and March of 2020 were investigated by Carter et al. (2021). The results showed that while firms with more leverage were more impacted by the pandemic, larger firms with larger cash reserves and higher market/book ratios were linked to fewer negative returns during the time. Furthermore, it is evident that the cash reserves previously given are a signpost for mitigating the risks associated with the pandemic period.

Nugroho (2014) set out to look into how the 2011 tsunami in Japan affected the Indonesian stock market. Based on his research, researcher discovered that there was no discernible anomalous return in the Indonesian stock market prior to or following the tsunami.

The stocks of businesses in the BIST 100 index and in the insurance industry reacted to the October 30, 2020, earthquake in Izmir, according to a different study by Hamurcu (2022) that looked at the impact of earthquakes on stock prices in the industry. The event study approach was used to examine the responses. The results demonstrated that the insurance sector equities' cumulative returns for 15, 30, 45, and 60 days were negatively impacted by the earthquake.

Say and Dogan's (2023) study looked at how stock returns were impacted by the February 6, 2023, earthquake, which struck 11 provinces. It was attempted to ascertain whether they may obtain abnormal returns during Turkey's earthquake time by using the event study method. Daily data from BIST 30 companies between January 16, 2023, and March 3, 2023 were used in the study. The analysis shows that on the day of the event and the first day following the event, there is a positive anomalous return. On the other hand, the second day following the occurrence shows a negative abnormal return. Furthermore, after the third day of the event, no statistically significant average aberrant return was found.

Kırkağaç and Karpuz (2023) explored the effects of the Kahramanmaraş earthquake on banking and insurance in a different study. The Kahramanmaraş earthquakes of 2023 were found to have a detrimental effect on the businesses included in the BIST bank and insurance indices.

Upon reviewing the literature, it is evident that other comparable research have been carried out. This study will show a contemporary application and outcome since a relevant industry was chosen following the disaster.

4. Data and Method

Data from 16.06.2022 to 15.03.2024 were utilized in the Borsa Istanbul (BIST) Stone and Soil Based Industry Index to observe the effects of the 2023 earthquake. Because this dataset represents a current situation, and it was employed.

Standard approaches are known to be inadequate in spotting bubbles when a time series has cyclic collapse behavior (Evans, 1991). Phillips et al. (2011) recommend using the SADF test to determine whether bubbles are present. To perform SADF testing, recursive regressions connected to ordered right-sided unit root tests must pass. To ascertain the high volatility of the unit root behavior, sequential tests are employed. When a single bubble is present in the sample, the SADF technique performs well in identifying it. A long sample period, however, may result in a lot of bubbles in the time series. Phillips et al. (2013) found that when a time series includes many bubble phases, the SADF technique is no longer able to analyze bubbles and cannot account for their presence. Though it uses customizable window widths, the GSADF test is based on recursive right-handed ADF tests, exactly as the SADF test. Researchers have recommended the more effective GSADF test (Phillips et al., 2013). The model of GSADF is displayed below.

$$GSADF(r_0) = \sup_{r2\in[r0,1],\, r1\in[0,r2-r0]} \{ADF_{r1}^{r2}\} \qquad (1)$$

5. Findings

We started by examining the Xtast and its stock prices. More expensive equities, in instance, tend to move more in line with the index. Following the earthquake on February 6, there was a noticeable spike in price fluctuations. We used the GSADF test to see if this rise resulted in a price bubble.

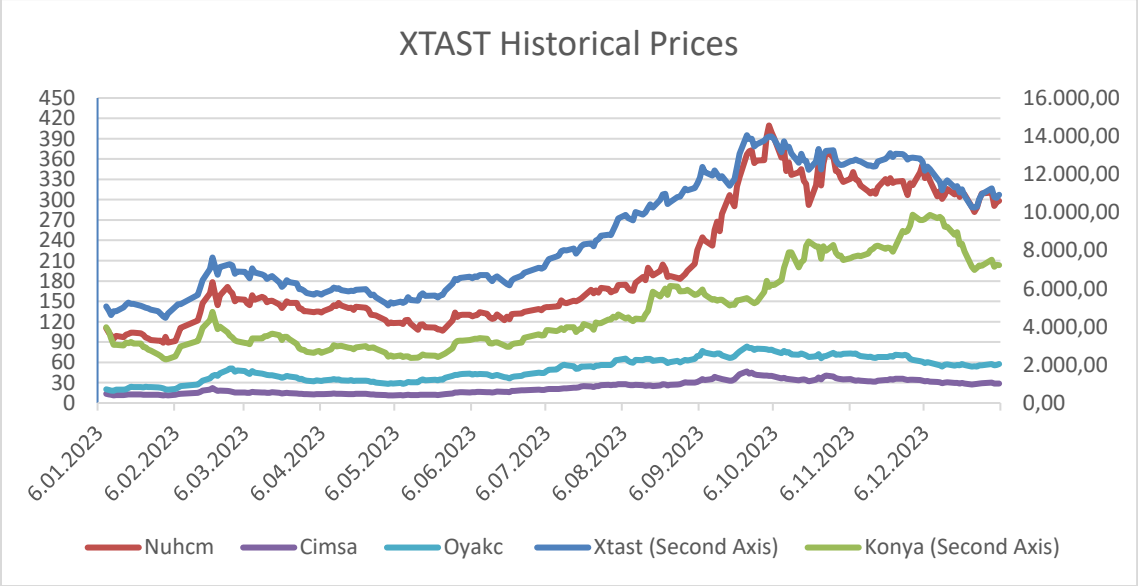

Figure 1. XTAST Historical Prices

The GSADF test was used in the study to determine whether there were any bubbles in the XTAST pricing. Empirical research has revealed the existence of a bubble.

Table 2. GSADF Findings

	GSADF Test Statistics	XTAST GSADF Value	Probability
99%	1.850277	3.063342	0.000
95%	1.385454		
90%	1.170284		

The cement business experiences price changes due to the interplay of several variables. First of all, variations in the cost of raw materials, such limestone, have an impact on manufacturing costs and are thus reflected in pricing. In addition, a number of other significant variables that affect cement pricing include energy costs, the balance between supply and demand, the competitive environment, governmental tax and regulation policies, and currency rate variations. Figure 2 shows ten distinct price bubbles that occurred between 2022 and 2024 and were impacted by a variety of events, such as earthquakes and other market dynamics. The figure shows that after the earthquake, on February 15, one of the most noticeable bubbles appeared as investor confidence responded significantly to the disaster's structural and economic impacts. Supply chain worries, anticipation for reconstruction efforts, and speculative trading were probably the main causes of the price spike, which persisted over the next few days and peaked on February 21. The bubble burst on February 22 as a result of a strong decrease brought on by market corrections and profit-taking, but this rising impetus was only temporary.

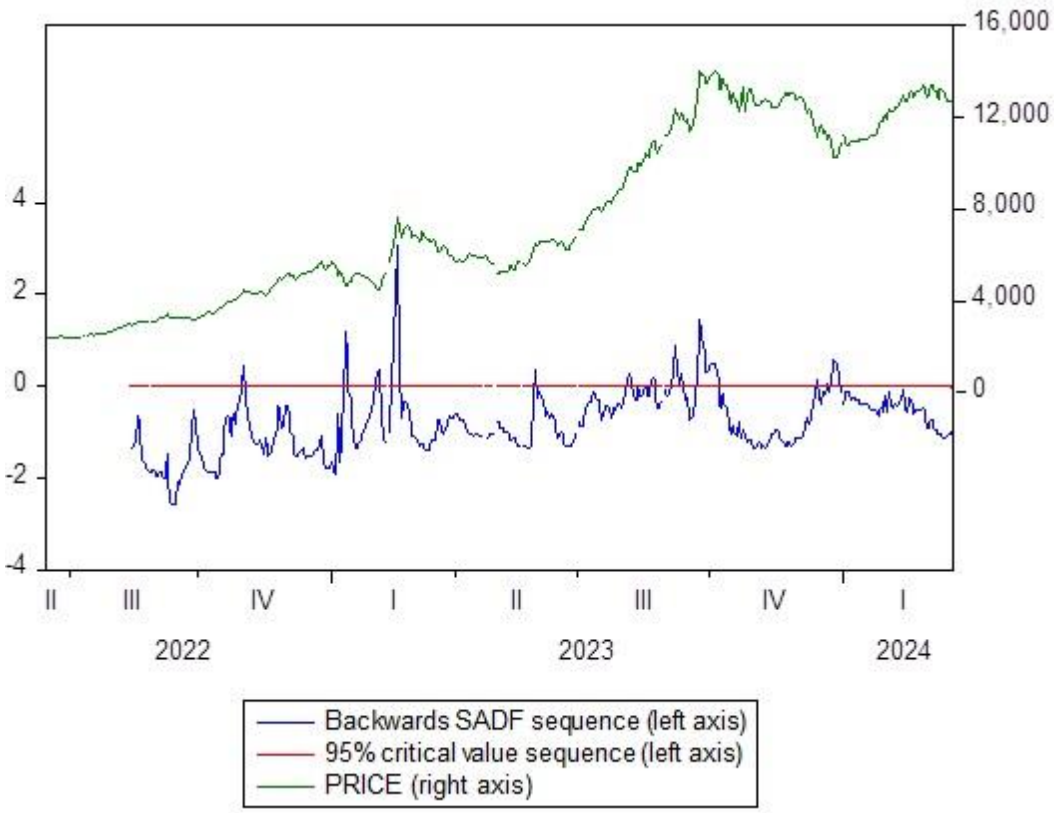

Figure 2. XTAST Price Bubbles

6. Conclusion

The production of materials and products obtained by mixing inorganic materials like clay, kaolin, quartz, feldspar, and limestone in certain proportions, shaping them with appropriate methods if necessary, and firing them at 800-1700 0C is typically done by the stone and soil-based industry using the most recent technologies (Aytekin and Guler, 2014). The following industries do not have public establishments: the plaster, glass, cement, ready-mixed concrete, lime, prefabricated building elements, refractory materials, ceramic coating materials, ceramic sanitary ware, tableware and ornaments, technical It is divided into 12 subsectors, which include the brick and tile and ceramic industries. In the near future, ceramics and other items will be available on the local market due to the macroeconomic conditions of our nation and the growing potential of the building sector. There's a chance that rising demand may exhaust the available manufacturing capacity (DPT, 2006). Under more competitive conditions, labor-intensive businesses in the stone and soil-based industry will be able to provide themselves a competitive edge with fewer variables (Aytekin and Guler, 2014). The industry is also greatly impacted by the possibility of a large-scale earthquake with disastrous consequences. This study looked at the impact of the earthquake that occurred on February 6 in this particular environment. The GSADF test revealed ten distinct price bubbles between 2022 and 2024 as a result of the earthquake and other factors. The earthquake caused a pricing bubble to burst on February 15. The bubble reached its peak on February 21 and exploded on February 22. The significance of the measures that the government should take with regard to the stock market has become clear if we discuss the price bubbles that were observed, particularly following the earthquake. Perhaps there wouldn't have been as many price swings if the stock market had been shut down right away following the earthquake. Therefore, authorities should take prompt action to prevent significant price swings, whether good or negative, especially during disasters.

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