**Stock Market Trends**

**Abstract**

Investors face a variety of challenges when analyzing shares. An enormous flood of information makes it difficult to filter the most important data and make well-founded decisions about buying and selling shares. Extreme events in particular, such as natural disasters, can have a major impact on stock markets and are also difficult to predict. We have created a tool in which we correlate the most important data from natural catastrophes and stock markets and present them graphically. Our tool aims to demonstrate how major earthquakes (magnitude over 6) impact global markets, aiding investors, economists, and decision-makers in understanding market behavior changes due to such events.

By providing well-founded analyses and recommendations, the tool could help investors avoid emotional decisions and act based on data and could assess risks and opportunities in real-time, helping investors adjust their portfolios accordingly.

**Overview**

We received 16 datasets containing information about Stock market data (from 2008 to 2023) and Earthquake data (from 1990 to 2023). The key questions we want to solve are:

1. How is the impact of natural disasters on the stock market - in the short (one day) and long term (ten days)?
2. Are there specific sectors (e.g., energy, real estate, insurance, ...) or regions that are more sensitive to earthquakes in terms of market performance?

**Our Approach:**

1. Evaluate data availability:

We first checked the data sets provided for their format. All 16 datasets were in CSV format. 15 datasets contain the stock prices, one dataset contains all data on natural disasters.

1. Exploratory data analysis (EDA) :

We were able to determine an identical structure in the data sets for the share prices. All CSV files contain the open and close prices of 12 stock indices per day. One file contains all data for one year. All 15 data sets could therefore be merged.

The dataset on natural disasters contains 25 different types of natural disasters, as well as their time, geodata (city, country, longitude, latitude) and information on their strength (magnitude and significance). We did not find any missing, duplicate or unrealistic values in any of the data sets. The data on natural disasters starts in 1990, the data on the stock markets in 2008. In order to link both data sets, the date could prove to be a suitable primary key.

1. Proof of Concept (PoC):
   1. *Regression: Linear Results*

These are the results of our linear regression model. We used daily changes in each market as our dependent variable and these characteristics of earthquakes with a magnitude of 6 and above happening in the period between two consecutive market closes. Here an example of our Findings for Japanese Market:

*Findings:*

* Japanese Nikkei Stock Exchange (N225): Affected by both the number of earthquakes and the maximum magnitude. Number of earthquakes has a significant negative relationship with the change in the N225 index, and maximum magnitude has a tiny positive effect.

*3.2 Multinomial Logistic Results*

We measured the difference in change of a market compared to the average of all others and then assign 0, 1, 2, and 3 based on the difference of these two numbers. This method isolates the markets from other factors. Significant results were found for 7 markets. Here the results Japan and Nikkei Market as an example:

*Findings:*

* N225: Higher number of earthquakes increases the odds of effect 2.

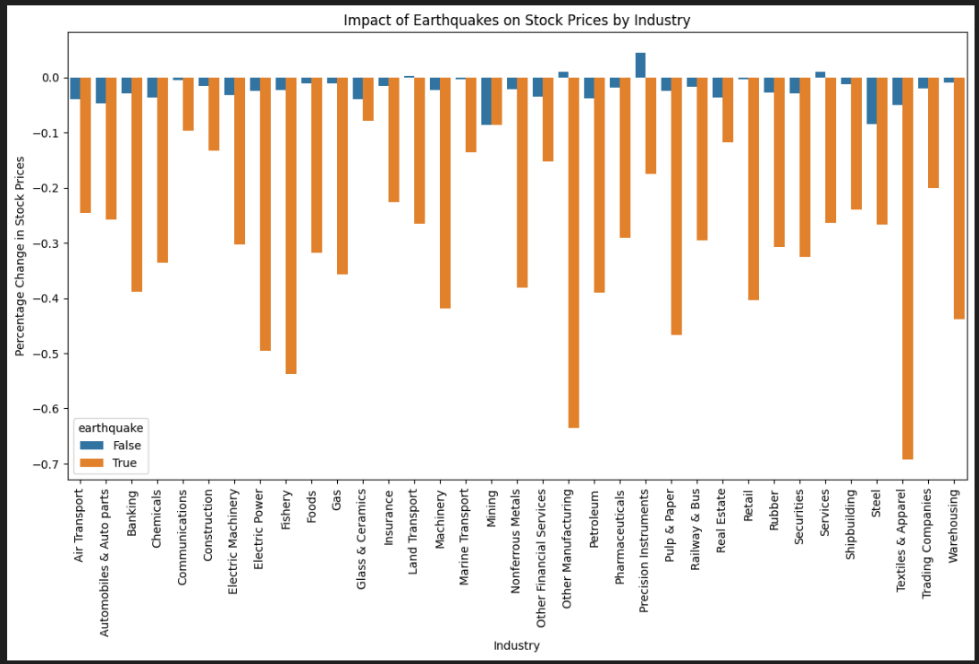
*3.3 Market Analysis*

To expand our Analyses, we have not only focused on stock indexes, but also considered the stock values of individual companies and their industry. Regression analyses have shown that earthquakes can have significant impacts on stock markets, especially in Japan, Europe, China and India. Therefore, we have integrated datasets from all individual companies (including the industry) in the indexes with their open and close values on each day. Here are the results for Japan and the Nikkei Market as an example:

1. Analysis of the impact of Earthquakes on Stock Prices by Industry.

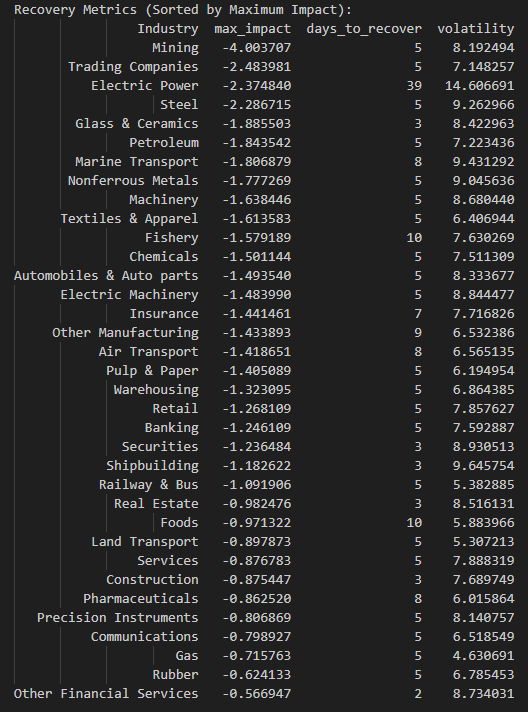
The height of each bar represents the average percentage price change on days with an earthquake (“True”) and without an earthquake (“false).

* **In this chart, all industries have Negative Impact (True > False)**



1. Analysis of the Market Recovery Pattern in a 40 Days Window:

Metric Definitions:

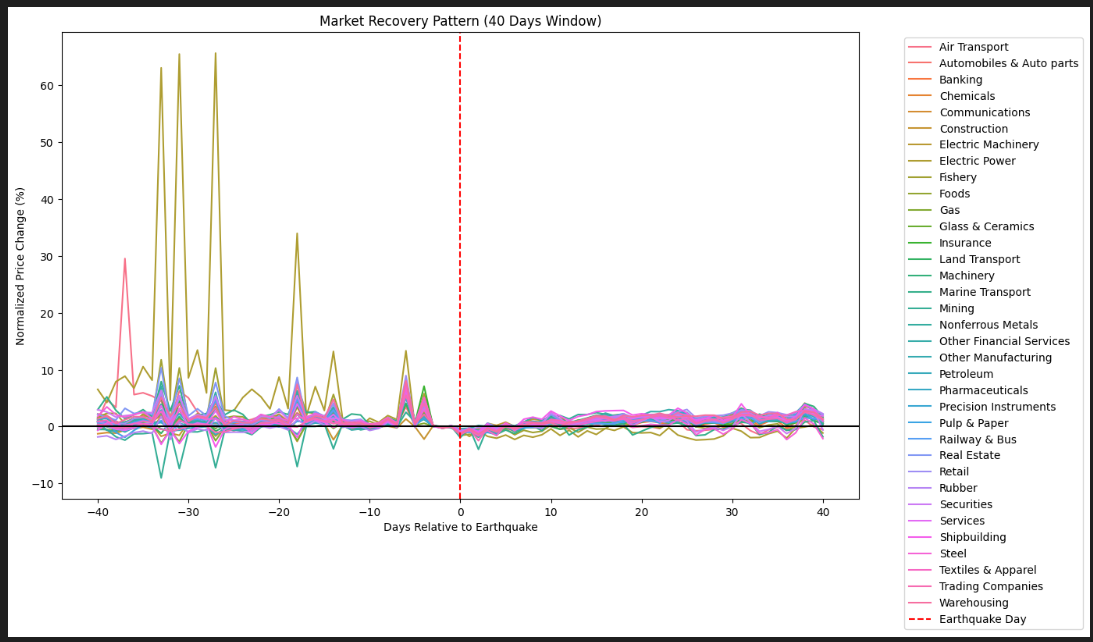
* *max\_impact:* The largest percentage drop in stock prices immediately after an earthquake.
* *days\_to\_recover:* Time (in days) for stock prices to return to pre-earthquake levels.
* *volatility:* Magnitude of price fluctuations during the recovery period (higher = more instability).

*Key Observations:*

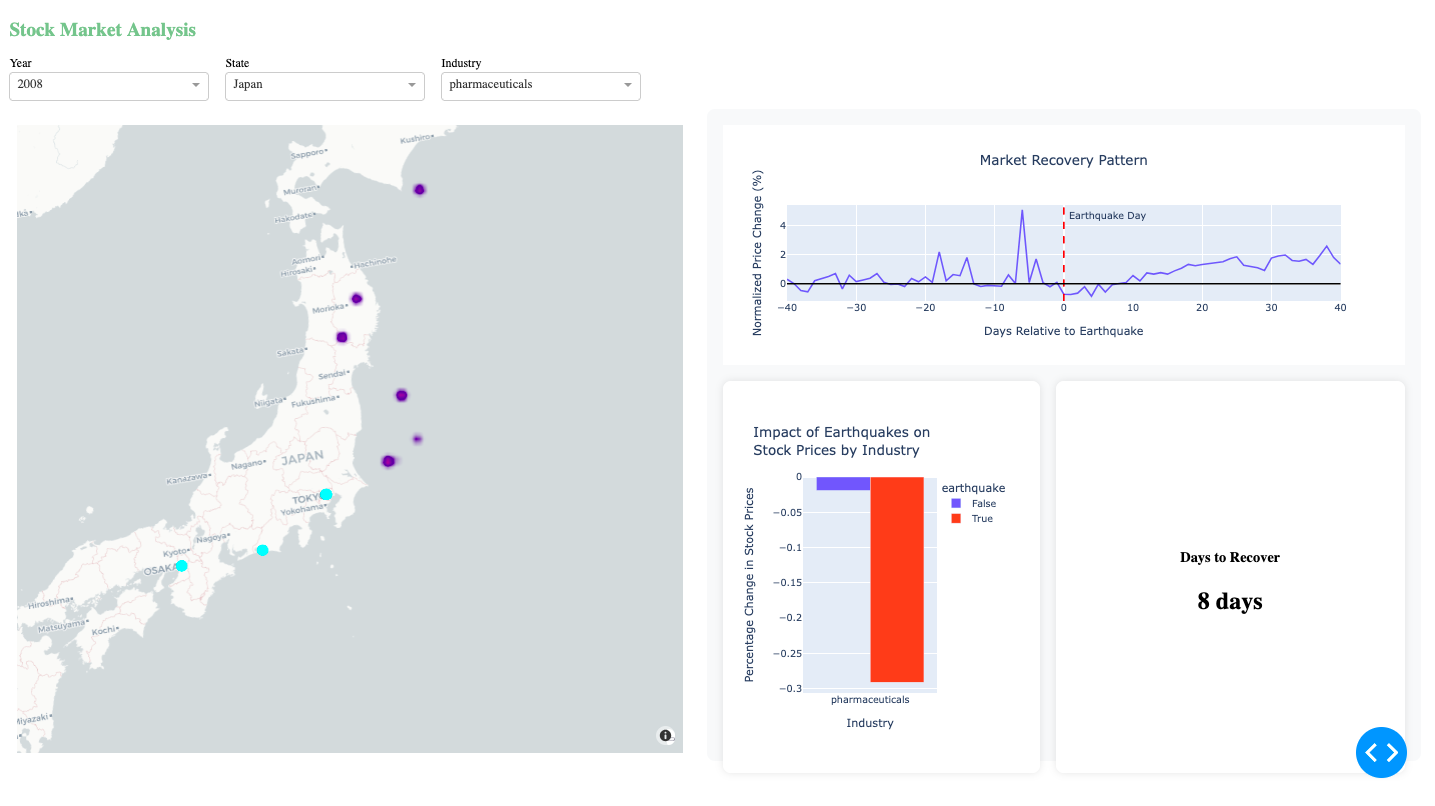
1. All industries experienced negative stock price impacts (all max\_impact values are negative), suggesting earthquakes generally correlate with short-term market declines.
2. Recovery times vary widely: Some industries rebounded in 2–5 days (e.g., Glass & Ceramics, Securities), while others took weeks (e.g., Electric Power: 39 days).
3. Volatility is highest in industries with prolonged recovery (e.g., Electric Power: 14.6 volatility), indicating prolonged uncertainty.

*Suggestion:*

* Investors: Avoid industries with high max\_impact and slow recovery (e.g., Electric Power) during seismic activity. Consider short-term volatility in mining.
* Companies: High-impact industries (mining, power) should prioritize disaster resilience and investor communication.



1. Minimum Viable Product (MVP)

 We have created a dashboard on which the corresponding analyses are displayed graphically in order to make the information collected available to the target group as required. Depending on the filters set (year, region, industry), investors can identify the optimum time to buy or sell shares by looking at the development of share prices over time. The analyses are graphically supported by an interactive map on which the earthquakes and companies are displayed.

**Project Team**

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GitHub Repo: [**Techlabs\_WS\_Team3**](https://github.com/jahostm/Techlabs_WS_Team3)