

Crisis and Capital: How COVID-19 Rewired Sectoral Resilience and Stock Market Dynamics

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Contributions

Lola: Data transformation, analysis and visualization. Proofread and Organized report: wrote results, conclusion and limitations

Luqi: Gathering Data and Data processing. Proofread and wrote introduction and methods

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Abstract

This study investigates the impact of the COVID-19 pandemic on the US stock market by analysing historical stock data from Yahoo! Finance (2019-2025) using Python libraries such as pandas, yfinance, and matplotlib. The research compares pre- and post-pandemic market performance, focusing on stock price trends, sectoral performance, and volatility in the US stock market. Key findings reveal a 37% decline in stock market prices in March 2020, followed by a rapid recovery. Showed significant differences in sectoral performance, mainly with innovative industries, such as technology and healthcare sectors benefiting from the pandemic, while traditional industries, such as energy and hospitality, struggled. Volatility analysis highlighted persistent instability in commodity-driven industries. While the research provided valuable guidance on how societal events, such as the pandemic, could affect the stock market, limitations exist in accounting for gaps in emerging sectors and potential bias from delisted companies.

Introduction

The COVID-19 pandemic, declared by the World Health Organization (WHO) on 11 March, 2020 (Cucinotta D, 2020), had far-reaching and unprecedented economic consequences. As governments implemented lockdowns and restrictions to curb the spread of the virus, financial markets became highly volatile, and economic activity ground to a halt, with major indices such as the S&P 500 falling sharply (Mehrotra, 2023).

During this period, sectoral performance diverged significantly. It is well known that the stock price of healthcare companies increased because of the production of vaccines and medications. Meanwhile, the travel and hospitality industries suffered declines due to lockdowns. However, the performance of other sectors, such as technology and energy, which takes up a significant portion of the stock market, remains less clear.

Understanding these sectoral trends is critical for multiple stakeholders. Suppose a similar societal event occurs in the future. In that case, investors will have a better understanding of which stocks are likely to rise and which industries may see declining stock prices, allowing them to seize profit opportunities. Publicly traded companies can develop contingency plans to prevent stock price declines. Financial analysts can further refine stock price prediction models to improve accuracy. With this, we sought to answer the following: which sectors were most impacted by the pandemic, and how did their recovery trajectories differ? How did volatility patterns shape sectoral risk profiles during and after the pandemic?

To address these questions, we analyzed historical stock data from Yahoo! Finance (January 2019 - March 2025) using descriptive statistics analysis. A line plot was used to track the overall market trends, boxplots to compare pre- and post-COVID returns to measure performance divergence across sectors, and volatility analysis to identify sectors that are most vulnerable to market turbulence.

Methods

1. Web Scraping for Most Active Stocks Symbols

To gather the most active stock symbols, we used Selenium and BeautifulSoup to extract a list of the most actively traded stocks from Yahoo! Finance. The scraping process began by initializing the Firefox WebDriver in headless mode, which allowed for automated browsing without opening a graphical user interface. This setup ensured efficient and uninterrupted data collection, navigating through multiple pages of the "Most Active Stocks" section. BeautifulSoup was employed to parse the HTML content of each page, enabling the extraction of stock names by targeting `` elements with class attributes containing the keyword "symbol." The extracted stock symbols were cleaned (removing leading/trailing spaces) and compiled into a consolidated list, resulting in 352 unique and uniformly formatted stock symbols. This list served as the foundation for subsequent data analysis and sector-based trend comparisons.

2. Stock Data Download

After collecting the stock symbols, historical stock data was downloaded using the `yfinance` library in Python. The `yf.download()` function was employed to retrieve historical data for all 352 stocks, covering the period from January 1, 2019, to March 10, 2025. This timeframe was selected to capture trends before, during, and after the COVID-19 pandemic. The `group_by='tickers'` parameter was used to organize the data by individual stock tickers, ensuring a structured and accessible format. The dataset included daily stock metrics such as Open, High, Low, Close, Adjusted Close, and Volume, enabling detailed analysis of individual stock trends over time.

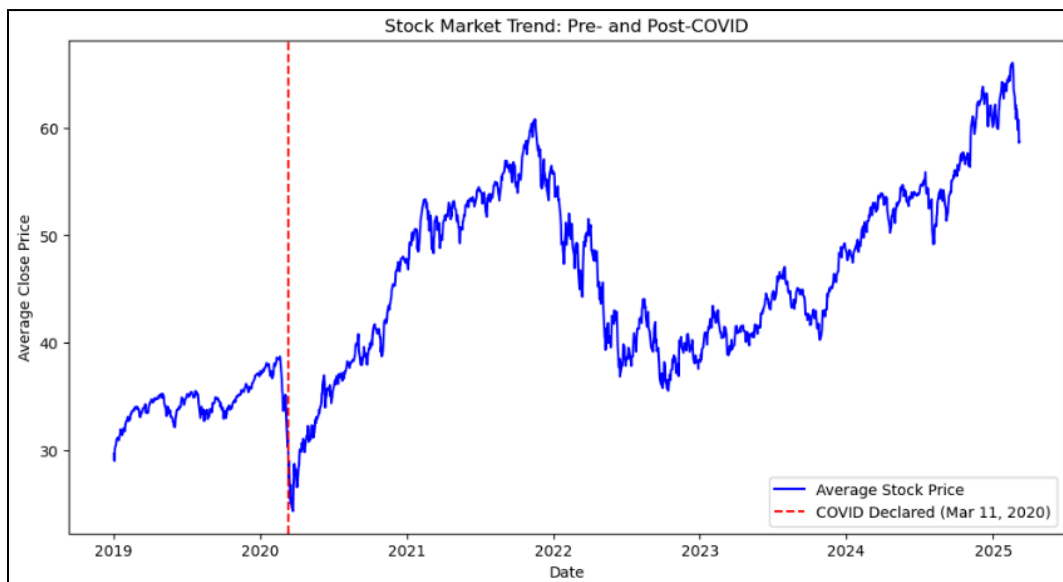
3. Industry Classification

To analyze stock trends by sector, each stock was classified into its respective industry. It began by examining the attributes of a sample stock (e.g., AAPL) using the `yf.Ticker()` object, identifying the "industry" attribute as the key label for sector classification. A loop was then implemented to iterate through all stock symbols in the `ordered_stock_names` list. For each stock, the `yf.Ticker()` object accessed the `info` dictionary to extract the "industry" attribute, defaulting to "N/A" if the attribute was missing. To avoid rate-limiting, a 1-second pause (`time.sleep(1)`) was added between requests. The extracted data—stock symbols and their corresponding industries—were stored in a dictionary (`tickers_data`) and later converted into a pandas DataFrame with columns "Ticker" and "Industry" for structured analysis.

Results

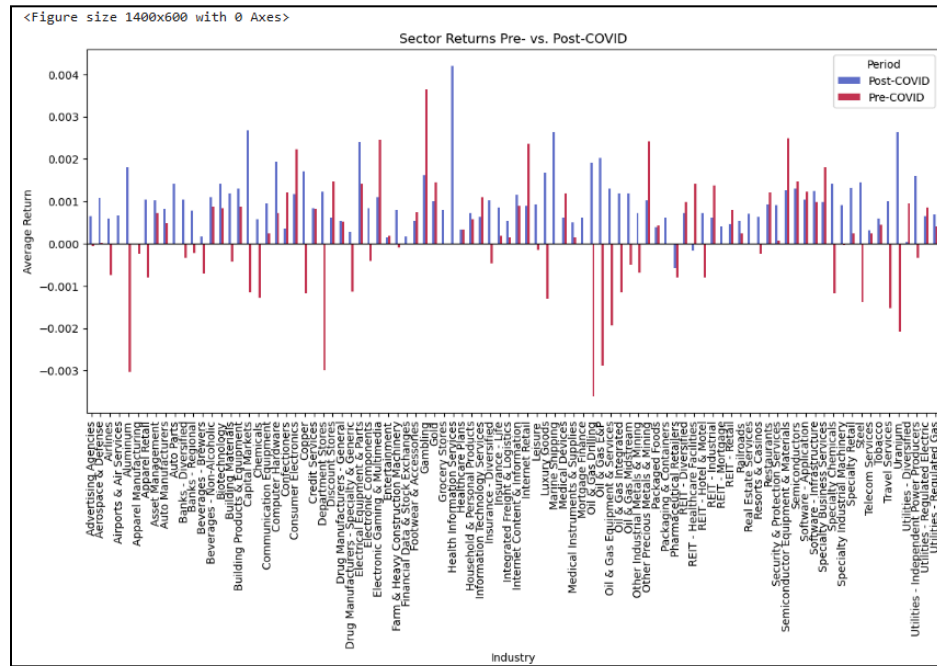
Before analysing market trends, the dataset was transformed to ensure structural consistency and facilitate sectoral comparisons. The dataset had initially contained multi-index columns (e.g. nested metrics like AMZN_Open, AMZN_Close) for each stock. Columns were flattened to concatenate the ticker and metric labels. The data frame was then reshaped from a wide to long format, separating the concatenated “Ticker_Metric” column into distinct “Ticker” and “Metric” variables. The data was then pivoted to reconstruct “Open”, “High”, “Low”, “Close”, and “Volume” as columns, allowing time-series calculations. Merging with industry classifications had ensured sectoral grouping for downstream analysis.

Overall Market Trend



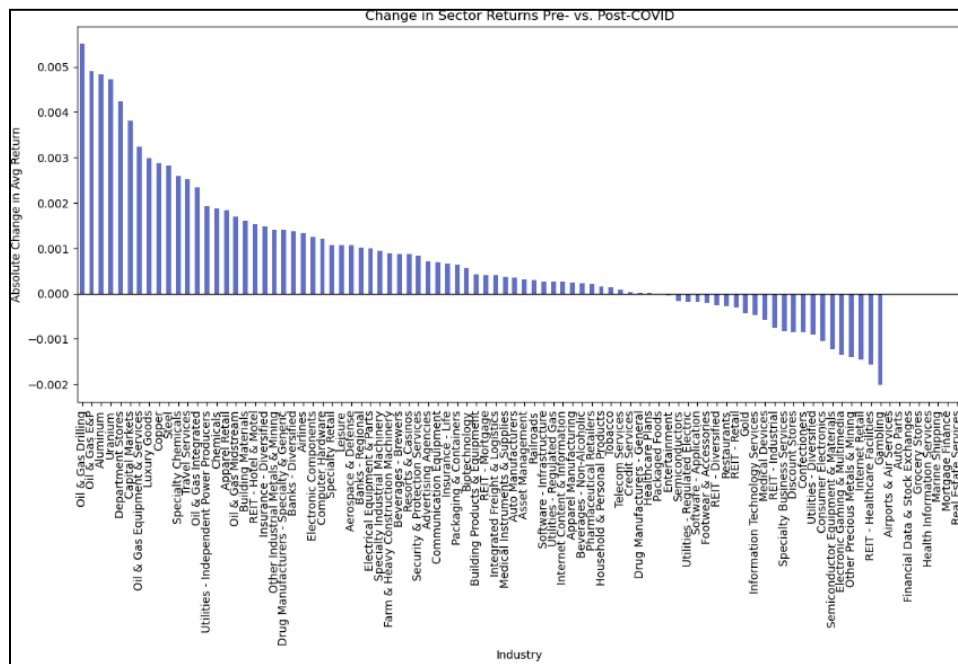
The line plot above illustrates the aggregated performance of all analyzed stocks, normalized to reflect average closing prices. A steep decline of 37% had occurred between February and March 2020, around where the red dashed line is located, which is the time of the COVID-19 pandemic declaration (March 11, 2020). This collapse mirrored global uncertainty, supply chain disruptions, and panic-driven sell-offs when the pandemic declaration was just made. However, after the panic, the data exhibited a rapid increasing trend, restoring itself to normal by August 2020, suggesting a rapid market recovery. The rebound was likely a result of aggressive fiscal interventions, accommodative monetary policies, and accelerated digitization, which benefited sectors as technology and healthcare. Post-recovery, the stock market had exhibited a gradual increase through 2021 to 2022, but was stopped and instead decreased through 2022-2023, as inflation occurred to restore the normal stock market trend. As we can see from the plot, the trend from 2023-2024 displayed a similar pattern to the stock market trend pre-pandemic (2019-2020).

Sectoral Performance Divergence



The bar chart above compares sectoral returns pre-COVID and post-COVID, blue bars and red bars denoting post-pandemic performances and pre-pandemic baselines respectively. Overall, we can observe a distinct divergence between traditional industries, as traditional retail, and sectors aligning with digital transformation and healthcare.

To better observe the impact of the pandemic on sectoral performance, the bar chart below illustrates the absolute change in average returns between the pre- and post-COVID periods.



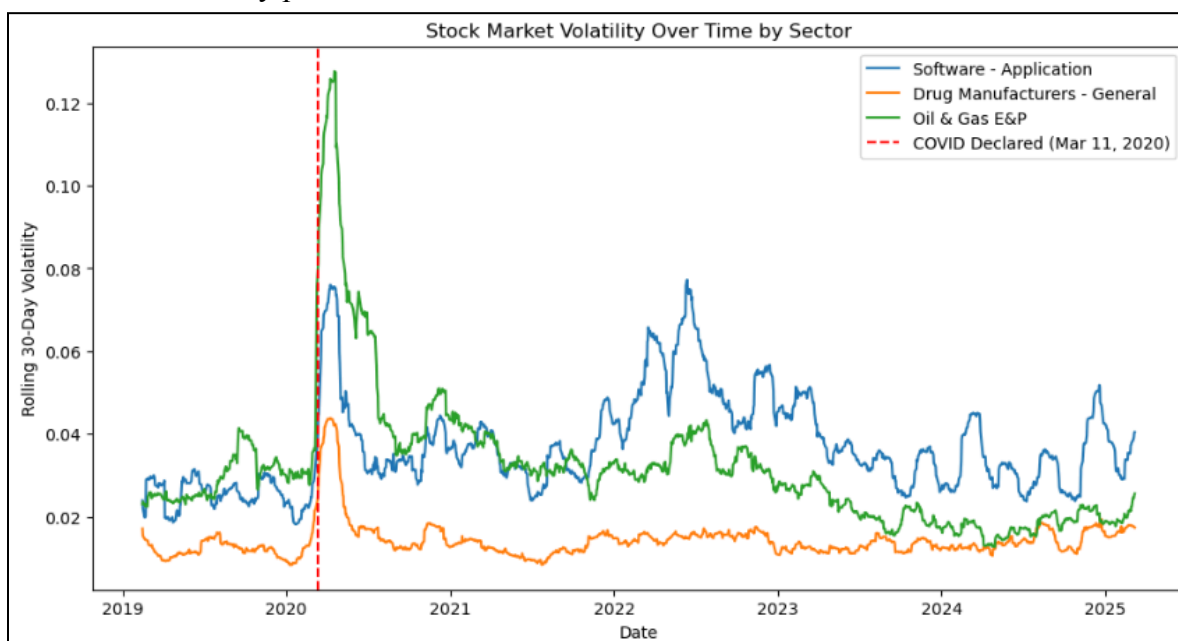
Among the top performers, oil and gas drilling ($> +0.5\%$) and oil and gas E&P ($\sim +0.5\%$) sectors showed the largest absolute increases in returns, as COVID restrictions eased on travelling. Gains are also observed in sectors uranium and aluminium, with gains around 0.5% , reflecting the recovery of industrial activity. REITs in Healthcare Facilities and gambling, however, showed losses of around 0.2% .

There are some limitations to the analysis, as some industries, such as airports and air services, and marine shipping lacked sufficient data for comparison. Additionally, survivorship bias may have inflated post-COVID returns for companies surviving the pandemic, as firms that were delisted in the stock market or went bankrupt were excluded from the data.

Volatility Dynamics

Volatility measures the degree of variation in an asset's price over time and is a key indicator for risk in the stock market. Stocks or sectors with higher volatility indicate that they are riskier, as their prices tend to experience rapid and unpredictable changes. Thus, volatility is a crucial metric for investors to assess potential gains and losses.

To investigate the volatility, rolling 30-day standard deviations were calculated for each sector, providing a dynamic measure of volatility over time. The plot below revealed notable differences in volatility patterns across the industries before and after the COVID crisis.



The oil and gas sector experienced the most notable volatility spike ($>12\%$), it was likely due to the decrease in global demand resulting from lockdowns during the pandemic declaration. Its volatility had remained elevated ($>8\%$) through 2021, reflecting ongoing supply-demand imbalances. The technology sector (software - application) revealed a sharp but brief increase in volatility, peaking at 9% , possibly due to the investor uncertainty during the rapid shift to remote work. And by late 2020, its volatility stabilized near 3% . The healthcare sector (drug manufacturers - general) exhibited moderate volatility (6%) during the pandemic's initial phase,

fluctuating with vaccine trial updates, and by mid-2021, returned to pre-pandemic levels (~2%), aligning with the widespread vaccine distribution and reduced uncertainty.

Conclusion and Limitations

This research examined the impact of the COVID-19 pandemic on the US stock market from 2019 to 2025, identifying critical trends in market resilience, sectoral performance divergence, and volatility dynamics. Our analysis showed that there was a sharp 37% stock market decline in March 2020, followed by a rapid recovery. In the post-recovery period, sectors as technology and healthcare thrived, while traditional industries as energy and hospitality faced prolonged challenges. The volatility patterns supported our observations, with the energy sector experiencing ongoing instability, while the technology sector stabilised as remote work became more common.

Although the analysis offered useful insights into how the pandemic impacted the stock market, it has some limitations. Missing data for emerging sectors (e.g. airports, marine shipping), and potential bias from excluding companies that were either delisted in the stock market or gone bankrupt. Even so, it provides valuable insight for investors and policymakers. Investors could better identify and focus on sectors that are more resilient to economic shocks and major societal events, while policymakers could focus on stabilizing vulnerable industries.

While the analysis provides a foundational understanding of pandemic-driven market dynamics, future research could enhance robustness by integrating macroeconomic indicators (e.g., inflation, unemployment) and addressing survivorship bias.

Reference

Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. *Acta Biomed.* 2020 Mar 19;91(1):157-160. doi: 10.23750/abm.v91i1.9397. PMID: 32191675; PMCID: PMC7569573.

Mehrotra, N. (2023, August 10). The aftermath and impact of covid-19 on stock markets. *Forbes*. <https://www.forbes.com/councils/theyec/2023/02/10/the-aftermath-and-impact-of-covid-19-on-stock-markets/>

Challenges

1. One of the challenges we faced was dynamically scraping stock symbols by simulating clicks on the 'Next' button.

Code Appendix