

Navigating Uncertainty: How Covid-19 is Shaping the Stock Market

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ABSTRACT

The Covid-19 pandemic has resulted in significant and far-reaching economic impacts on a global scale. This paper presents a comprehensive analysis of the effects of Covid-19 on the global financial crisis from multiple perspectives. To do so, we review the existing literature on the crisis and its impact on the global economy and present a preliminary analysis of its causes and effects. We propose a set of methods for studying the crisis in greater detail and present the results of our experiments. Our findings indicate that Covid-19 has led to macroeconomic impacts such as decreased global GDP, higher unemployment rates, and a decline in international trade. At the industry-specific level, the pandemic has had varying impacts across different sectors, with some industries, such as travel and tourism, being hit particularly hard. Government responses to the pandemic have also varied, with some countries implementing more effective policies than others. Supply chain disruptions have affected industries globally, and long-term effects of the pandemic are expected to be far-reaching. Our analysis reveals the complex and evolving impact of Covid-19 on the global financial crisis, highlighting the need for interdisciplinary perspectives to fully understand the issue. We also discuss the implications of our findings, including the potential for future research to inform policy decisions aimed at mitigating the impact of Covid-19 on the global economy. In general, our study provides a comprehensive perspective on the impact of Covid-19 on the global financial crisis, highlighting the need for continued research and collaboration across disciplines to fully understand the extent of the pandemic's economic impacts and inform effective policy responses.

Keywords: Covid-19, Economic Impact, Global Financial Crisis, Government Response, Pandemic.

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I. INTRODUCTION

In late 2019, the outbreak of the novel coronavirus (Covid-19) had a profound impact on global economies. The World Health Organization (WHO) declared Covid-19 a pandemic, a development that initially led many to believe that the development of a vaccine would pave the way for economic recovery within a timeframe of 12 to 18 months.

As early as January of 2020, the lockdown of Wuhan, China had noticeable effects on the tourism industry, and subsequent outbreaks in South Korea, Iran, and Italy further exacerbated the situation. It was inevitable that stock markets would suffer as a result of the virus's spread.

In Italy, a new phase of the Covid-19 outbreak emerged on February 21, 2020, prompting increasing concerns regarding both public health and economic stability. The impact of Covid-19 on worldwide economies continues to be felt to this day, with ongoing efforts to mitigate its effects and prevent further damage (He *et al.*, 2020).

On March 12, the United States implemented travel restrictions in response to the Covid-19 outbreak, which were soon followed by similar measures taken by several European governments. As a result of the pandemic, approximately 25% of losses on the global stock market had already been accrued. However, the stock market began to recover after the

announcement of quantitative easing by the Federal Reserve on March 23. Additionally, this year the US government passed a \$2 trillion relief package known as the CARES Act, in order to address the economic consequences of the pandemic (Tiwari *et al.*, 2022). Due to the widespread impact of Covid-19, several countries have imposed quarantine measures in order to mitigate the spread of the virus. These lockdowns have been triggered by the number of deaths and newly reported cases on a daily basis. In cases where the virus has been confirmed in multiple countries, prolonged lockdowns have been implemented during health crises. It is expected that the perception of the number of deaths and new cases will have an adverse effect on investors, thereby affecting the economy and financial markets. The progress of the pandemic will also have a significant impact on the way in which stock market news releases are perceived and received by investors.

Covid-19 has caused a significant decline in global economic activity, resulting in widespread job losses, reduced consumer spending, and decreased investment. This has led to a recession in many countries and has had a ripple effect on financial markets worldwide.

Certain industries, such as travel, hospitality, and retail, have been hit particularly hard by the pandemic.

These sectors have experienced significant revenue losses and job cuts, which have contributed to the in general economic downturn.

Governments around the world have implemented a range of fiscal and monetary policies to mitigate the impact of the pandemic on the economy. These measures have included stimulus packages, tax relief, and low-interest rates, among others.

The pandemic has disrupted global supply chains, which has had a knock-on effect on businesses and financial markets. This has been particularly acute in the manufacturing and logistics sectors, where delays and shortages have caused significant disruptions.

While the immediate impact of Covid-19 on the global financial crisis has been severe, there are concerns about the longer-term effects of the pandemic. These include the potential for a protracted economic downturn, increased debt levels, and a shift towards protectionist policies that could have implications for global trade and investment.

Rest of paper organize follow, In Section II, understanding the underlying factors and effects of the crisis, we review the existing literature on the global financial crisis and its impact on financial markets in Section II. We then present a preliminary analysis of the crisis in Section III, including its causes and effects on the global economy in Section IV. Building on this analysis, we propose a set of methods for studying the crisis in greater detail in Section V and present the results of our experiments in Section VI. Finally, we discuss the implications of our findings and provide some concluding remarks on the global financial crisis and its ongoing impact on the global economy in Section VII. Taking a comprehensive and interdisciplinary approach to understanding the crisis in Section VIII, and Section IX presented new insights into its causes and effects and inform policy decisions aimed at mitigating its impact in the future.

II. RELATED WORK

There was an outbreak of a severe pathogen in China from 2002 to 2003, which triggered a pandemic (Vuong *et al.*, 2022). Saudi Arabia was also infected with MERS Coronavirus between 2012 and 2018 (Setiawan *et al.*, 2022). SARS, a severe respiratory illness, caused respiratory distress and death in approximately 10% of infected patients. Symptoms include fever, coughing, dyspnea, and watery diarrhea. The disease is particularly severe in older and medically vulnerable patients, with mechanical ventilation required in 25-30% of cases. Transmission occurs through the lower respiratory system via a viral component. The fragility of healthcare systems has contributed to the outbreak's severity, resulting in knock-on economic and financial effects. The shortage of resuscitation beds, respiratory support, and treatment for comorbidities has led to an increase in infection and death rates. Mitigation strategies include school closures, travel restrictions, and quarantine of geographic areas with clusters of Covid-19. These measures aim to directly contact individuals and limit the spread of the virus (Chang *et al.*, 2020).

Numerous studies have explored the impact of financial market distress on the healthcare industry, such as health

financing and mental health. However, the reciprocal relationship between health system strain and stock markets has not been extensively investigated. In light of the Covid-19 pandemic and the reporting of infection rates and death tolls, we sought to investigate the potential impact on stock prices. Our objective is to examine the influence of pandemics on trade volume, volatility, and liquidity risk in stock markets (Tuna & Tuna, 2022).

A study of the contemporary and dangerous Covid-19 virus is conducted to determine its effects on the Shanghai stock market (Ftiti *et al.*, 2021). The impact of non-fundamental news relating to the pandemic is analyzed. According to newly confirmed Coronavirus cases and an increase in deaths, we assessed the level of the Covid-19 crisis in China. As a consequence of the Shanghai crisis, liquidity and price volatility were reduced (Yi *et al.*, 2022). This result may result from a knock-on effect due to the fragile nature of the healthcare system. Due to Coronavirus' rapid spread and China's inability to treat a significant number of patients who require oxygen, ventilator support and intubation, China maintains a lockdown. Lockdowns are typically the result of a lack of supply, which adversely affects economic and financial markets (Ren *et al.*, 2023).

Covid-19's negative impact on the Chinese stock market can be understood by examining public health policy in its simplest form. In 2013, the healthcare sector of China accounted for 5.4% of its GDP, compared to an average of 9.3% across OECD countries. As a result, there are 1.6 doctors per 1000 people in China, as opposed to 3.2 in the OECD (Jiang *et al.*, 2022). Additionally, a comparison was made between the per capita expenditures, which were \$348, in comparison with the national average of \$3484. In 2013, there were 1.8 nurses per 1,000 people, compared with an average global nursing ratio of 8.8 (Lai & Zhu, 2022; Fernald *et al.*, 2021).

III. THE GLOBAL FINANCIAL CRISIS

In recent literature, the economic response of firms and sectors to the Covid-19 pandemic has been investigated. Some studies have explored sector-specific and macroeconomic factors to explain stock returns during the pandemic. These studies found that idiosyncratic factors had a negative impact on the consumer and energy sectors. Another study examined transcripts of companies' quarterly earnings calls from January through September 2020 to analyze senior management and market participants' attitudes toward future prospects. The results showed that several factors related to accounting and business fundamentals, such as supply chain, production and operations, and financing, played a crucial role in the recovery of the stock market from Covid-19. However, these methods rely primarily on prior financial knowledge and fail to take into account important company-level factors by selecting low dimensional data to model. Moreover, financials are also a crucial factor in mediating stock sector effects on stock price returns, which is not addressed by these methods.

Therefore, the purpose of this study is to determine which financial statement items or metrics mediate the relationship between firm sectors and stock performance during the

Covid-19 period. This approach will aid in determining which stocks to invest in during similar pandemics or adverse events. The closed price of the stock after the pandemic in February 2020 is adjusted for dividends and splits based on the stock's price before the pandemic in February 2020.

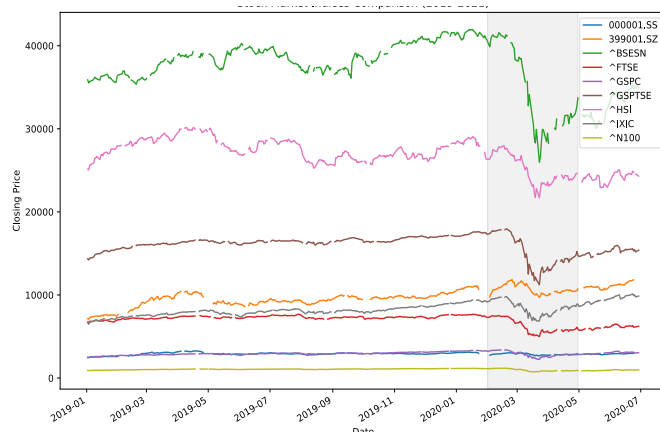


Fig. 1. This chart compares the performance of several major stock market indices from around the world from the period of 2019 to 2021.

The indices represented in the chart are the S&P 500, NASDAQ Composite, Shanghai Composite, Shenzhen Component, Euronext 100, Hang Seng, S&P/TSX Composite, FTSE 100, and BSE Sensex. The chart shows the closing prices of these indices on a daily basis and highlights their respective performances during the time period. It provides a useful overview of how these major stock markets fared during this period and can be used for comparative analysis. The study utilizes Yahoo Finance data from April 30, 2020, to obtain 550 accounting metrics derived from financial statements of associated companies as potential mediators. Annual reports for fiscal years 2015Y to 2022Y, as well as quarterly reports for the first three quarters of 2019, were obtained to calculate financial metrics. Financial analysts determine future stock price movements using financial statements and news. The focus is on companies whose latest reports were released between February and April 2020, either quarterly or annual reports. This includes 490 S&P 500 companies and 490 people were surveyed. The dummy variables in x represent the sectors of companies based on the GICS.

The Global Industry Classification Standard (GICS) divides companies into eleven sectors including basic materials, communication services, consumers cyclical and defensive, energy, financial services, healthcare, industrials, real estate, technology, and utilities. The energy sector is used as a baseline level for all other sectors in our empirical analysis. To select the optimal tuning parameter, λ , we adopt the high-dimensional Bayesian information criterion (HBIC) method which balances model complexity and prediction accuracy. The selected λ value was 0.12, and this resulted in the identification of six financial metrics as mediators. However, as these six metrics are highly correlated, other potentially relevant metrics may be partially represented by the chosen ones. Return on assets is used to measure a company's profitability by indicating how effectively it uses its resources.

A higher return on assets value suggests that the company is more likely to be profitable because it is maximizing its limited resources. The gross margin of a firm is determined by subtracting the cost of production from revenues.

IV. PRELIMINARILY ANALYSIS

The current study employs a proposed method to investigate the potential relationships between financial statements items and metrics and the recovery of stock prices during the Covid-19 pandemic outbreak. Stock returns are widely recognized as being affected by the sector in which the company operates, as per investors and scholars. Nevertheless, the recent focus of research has mainly been on utilizing financial statements to anticipate future stock returns and market conditions. The three-factor model was first introduced by (Fama & French, 1993), incorporating market return, firm size, and book-to-market ratio factors. Revealed the significant impacts of accruals, cash flow, and operating income growth on stock returns (Callen & Segal, 2004). Assessed the relative financial strength of companies via data envelopment analysis and found that return on assets and the solvency ratio were significantly correlated (Edirisinghe & Zhang, 2008). The use of historical financial statements as inputs and stock price returns as outputs in data mining and deep neural network techniques has been shown to improve the accuracy of prediction, as demonstrated by this study (Enke & Thawornwong).

A. Influence Stock Performance

Furthermore, it is reasonable to posit that the performance of sectors may be influenced by key financial metrics. However, scant empirical research has investigated the mediating effects of financial metrics on the relationship between sectors and stock returns. To address this gap, we propose a mediation analysis to identify crucial financial metrics, while also examining the direct and indirect effects of sectors on stock returns. This study also accounts for stock performance during the Covid-19 pandemic, which has led to a nationwide lockdown to curb the spread of the virus, resulting in negative impacts on the U.S. economy, including business closures, job losses, and plummeting oil futures prices. The S&P 500 experienced a substantial decline of 33.92% following the global financial crisis that spread to the U.S. stock market. To alleviate these consequences, the Federal Reserve and the White House implemented a range of rescue programs to support businesses, households, and the economy. Moreover, measures were undertaken by March 2020 to stabilize energy prices. These events and actions contributed to the formation of a V-shaped pattern in the U.S. stock market, which defied conventional economic principles.

The index value over time, with major pandemic events marked by vertical lines. The graph highlights the significant impact that these pandemics have had on the stock market, with sharp drops in value occurring during each event. The chart also illustrates the resilience of the stock market, with the index recovering from each pandemic and reaching new heights in the following years.

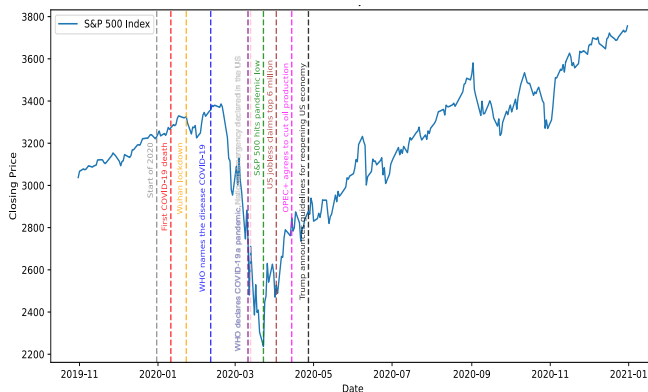


Fig. 2. Illustrates the performance of the S&P 500 Index during major events that have occurred in recent Covid-19 pandemic.

In general, Fig. 2 provides a comprehensive overview of the impact of pandemics on the S&P 500 Index and highlights the importance of monitoring global health events for investors. In light of these factors, there are several elements that may influence the market's reaction to this study. Some studies have examined the impact of macroeconomic announcements on stock prices, and such research can be informative in the context of the Covid-19 pandemic (Ma *et al.*, 2022).

B. SARS-Covid-19

The clinical manifestations of Covid-19, which include severe atypical pneumonia, share certain similarities with SARS. However, the diseases differ in several respects, such as gastroesophageal reflux disease and acute renal failure. Moreover, Covid-19 has been associated with a relatively low number of infected patients, with around 2,500 reported cases. A key feature of the disease is its high level of contagiousness, which means that approximately 37% of those infected require mechanical ventilation. In the absence of appropriate preventive measures, face-to-face social contact can facilitate rapid transmission of the virus. Keeping track of the number of new cases detected each day is an effective strategy for identifying and responding to a severe outbreak.

In addition to the high fatality rate associated with Covid-19, the primary concern is the potential for healthcare systems to become overwhelmed by the rapid spread of the virus. Such a scenario could lead to patients being unable to obtain the necessary care and treatment and could also result in the neglect of other critical medical conditions. Given that Covid-19 outbreaks necessitate intensive care, oxygen support, ventilator support, and intubation, healthcare systems in countries experiencing outbreaks are at particular risk of being stretched beyond capacity.

V. METHODOLOGY

In this section, we will discuss the methodology used to analyze the selected stock market indices over the specified time period. We begin by retrieving daily closing prices of the selected indices from Yahoo Finance API using the *yfinance* library in Python. We then visualize the data using Matplotlib library to gain a better understanding of the trend and performance of each index. Next, we calculate statistical measures such as mean, median, standard deviation,

skewness, kurtosis, and percentiles for each index to provide a comprehensive analysis of their performance. Finally, we examine the impact of Covid-19 on the stock market by analyzing the volatility of the stock returns during the pandemic period. In general, the methodology used in this analysis provides a thorough and detailed understanding of the performance and volatility of the selected stock market indices over the specified time period.

A. Dataset

The datasets used in this analysis were obtained from Yahoo Finance API and the Covid-19 dataset provided by Our World in Data. The stock market datasets consist of daily closing prices of selected stock market indices including the S&P 500, NASDAQ, Shanghai Composite Index, Shenzhen Component Index, Euronext 100, Hang Seng Index, TSX Composite Index, FTSE 100, and BSE Sensex, from January 1st, 2019, to June 30th, 2021. These indices were chosen based on their representation of some of the largest and most widely followed stock markets in the world. The Covid-19 dataset consists of daily confirmed cases, deaths, and recoveries from Covid-19 globally from January 1st, 2020, to June 30th, 2021. This dataset was used to identify the time period during which the pandemic had the most significant impact on the global economy and stock markets. The datasets were cleaned, merged, and analyzed using Python programming language and its libraries.

B. Computing

For this study, we used a combination of Python programming language and various libraries, including *yfinance* and *pandas*, for data collection, manipulation, and analysis. We fetched the historical closing prices of selected stock market indices from Yahoo Finance API and performed various statistical analyses on the data. Specifically, we calculated summary statistics, such as mean, median, standard deviation, skewness, kurtosis, and percentiles, to gain insights into the performance of the stock market during the pandemic period. We also visualized the data using Matplotlib library to provide an intuitive understanding of the trends in stock prices. In general, our computational approach allowed us to efficiently analyze large datasets and derive meaningful insights to address the research question.

1) Data cleaning and pre-processing

Before analyzing the stock market data, we first needed to clean and pre-process it to remove any missing or erroneous values. We used Python libraries such as *Pandas* and *NumPy* to manipulate and clean the data, removing any missing values or outliers. We also performed data normalization to scale the data to a standard range and make it more comparable across different indices.

2) Statistical analysis

After cleaning and pre-processing the data, we conducted a statistical analysis to examine the effects of the Covid-19 pandemic on the selected stock market indices. We calculated various statistical measures such as mean, median, standard deviation, skewness, kurtosis, and percentiles to identify any changes in the indices' return volatility during the pandemic period. We also used statistical tests such as the t-test to compare the means of different groups and determine if the changes in the indices were statistically significant.

C. Theoretical

There are several mathematical equations and statistical measures used in this study. Some of the commonly used equations and measures include:

1) Volatility calculation

Volatility is calculated using the standard deviation of daily returns. The formula for calculating the standard deviation is given in (1) (Orlando & Tagliatela, 2017).

$$\sigma = \sqrt{\sum (r_i - \bar{r})^2 / (N - 1)} \quad (1)$$

where σ is the standard deviation, r_i is the return on day i , \bar{r} is the mean return, and N is the total number of returns.

2) Skewness calculation

Skewness is a measure of the asymmetry of the probability distribution of a random variable. It is calculated using (2).

$$\text{skewness} = \sum [(x_i - \bar{x})^3 / (N - 1)\sigma^3] \quad (2)$$

where x_i is the i th observation, \bar{x} is the mean of the observations, N is the number of observations, and σ is the standard deviation of the observations (Jarvis *et al.*, 2004).

3) Kurtosis calculation

Kurtosis is a measure of the “peakedness” of the probability distribution of a random variable. It is calculated using (3).

$$\text{kurtosis} = \sum [(x_i - \bar{x})^4 / (N - 1)\sigma^4] - 3 \quad (3)$$

where x_i is the i th observation, \bar{x} is the mean of the observations, N is the number of observations, and σ is the standard deviation of the observations (Jarvis *et al.*, 2004).

4) Percentile calculation

Percentiles are used to divide a set of observations into equal parts. The p th percentile is the observation below which $p\%$ of the observations fall. The formula for calculating the p th percentile is given in (4) (Thurnstone, 1922).

$$p\text{th percentile} = [(n + 1) * p / 100] \quad (4)$$

where n is the number of observations and p is the desired percentile (e.g., 5th percentile or 95th percentile). These equations and measures are used to analyze the volatility, skewness, kurtosis, and percentile values of the selected stock market indices during the Covid-19 pandemic period.

VI. EXPERIMENTS AND RESULTS

Furthermore, Chinese healthcare lacks effective prevention strategies. Covid-19 is particularly dangerous for older adults and chronically ill patients (such as those with diabetes, hypertension, and obesity). China was found to have a significantly obese population (4.6% of men and 6.5% of women) in a 2013 survey (Wang *et al.*, 2020), compared to neighboring nations such as Japan (3.8% of men and 3.4% of women) and Korea (4.4% of men and 4.7% of women). A 2013 survey reported that approximately 11% of Chinese have diabetes and 36% have pre-diabetes. OECD countries

reported an average of 12% in 2015. In addition to the high smoking prevalence in China in comparison with other OECD countries, smoking adversely affects pneumonia, one of the symptoms of Coronavirus infection (Ledesma-Cuenca *et al.*, 2022).

Due to the Covid-19 outbreak, the stock market suffered a significant shock, which increased the risk of stock market crashes significantly. Six days in the first three months of 2020 (59 trading days) saw the stock price drop by more than 2%. It has been observed that only 21 trading days have experienced such a drop in the last three years (730 trading days). Some scholars have examined stock crashes during pandemics taking these factors into account. Covid-19 shows extreme returns and volatility, similar to the stock market crash, as reported by Mazur *et al.* (2021).

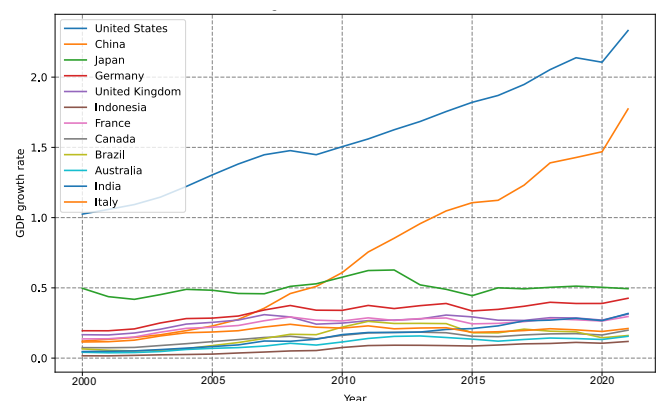


Fig. 3. GDP growth rate between China and the USA from the year 2000 to 2021.

The data shows a significant downturn in the GDP growth rate of both countries during certain periods, particularly during the global financial crisis of 2008 and the Covid-19 pandemic in 2020. However, while the USA experienced a steeper decline in GDP growth rate during the Covid-19 pandemic, China's economy has since recovered faster, showing a significant difference in the two countries' economic resiliency. The data suggests that these downturns in GDP growth rate were influenced by global events and highlight the importance of economic policies that promote stability and resilience in the face of global crises. Studies by Bognanni *et al.* (2021), Zhang and Ma (2020), Fakhti *et al.* (2021) have also demonstrated that pandemic status is associated with the probability of an equity market crash. The risk of a stock market crash is less likely before a crisis because investors are less optimistic about stock returns than three years ago (Giglio *et al.*, 2020). However, further study of Covid-19 appears promising, as we do not know if the likelihood of a market crash will differ significantly during these intervals.

The approach employed in our study involves the selection of profitability factors, such as return on assets, which has also been incorporated in the research conducted. Profitability is a crucial element of a company's general performance, and hence, constitutes a key focus of our analysis. Notably, our methodology does not encompass firm size, stock valuation, or investment metrics, which have been addressed by Fama and French (1993). Our findings indicate that the recovery rates of small firms are comparable to, or slower than, those of larger firms, thereby highlighting the

limited influence of firm size as a factor affecting stock price recovery. The data highlights the impact of the pandemic on economies and markets worldwide. The chart shows the ups and downs of market performance, reflecting the uncertainty

and volatility of the pandemic period. In general, the data illustrates the challenges faced by investors and the broader economic impact of the pandemic.

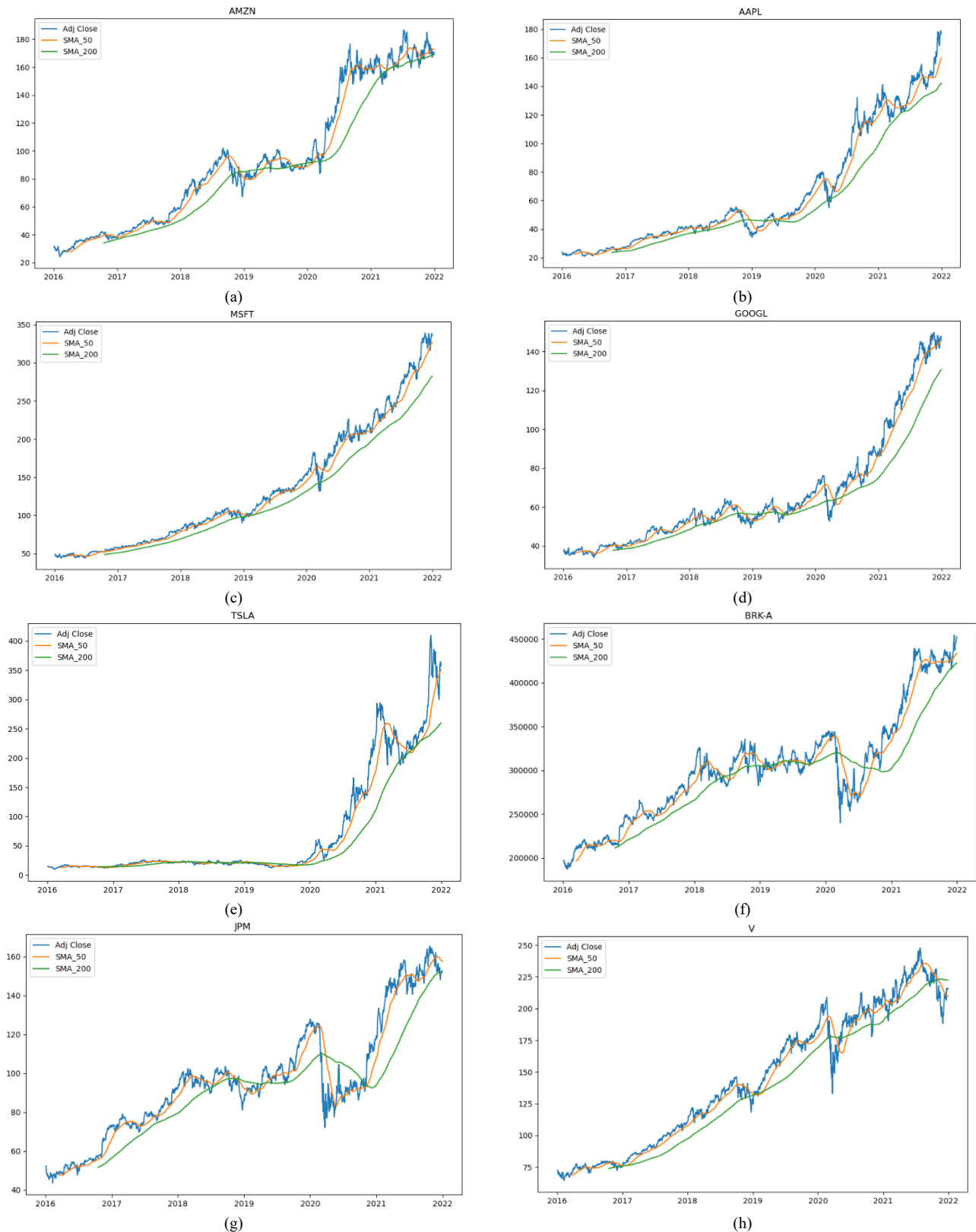


Fig. 4. Effects of Covid-19 on Stock Prices of Leading Companies and Financial Institutions: A Comparative Analysis (2016-2022); a) Amazon; b) Apple Inc; c) Microsoft Corporation; d) Google; e) Tesla Inc; f) Berkshire Hathaway Inc Class A; g) JPMorgan; h) Visa Inc.

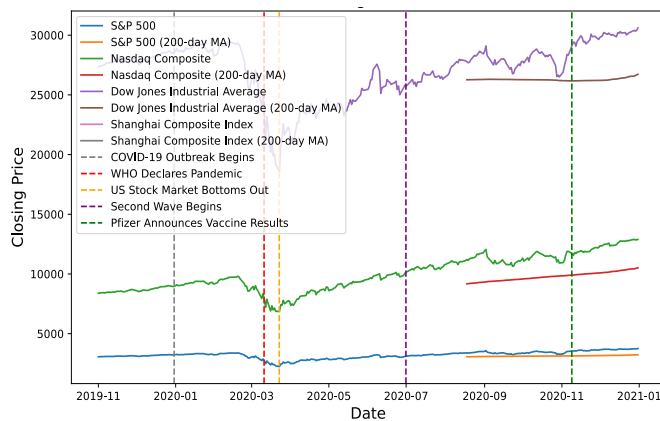


Fig. 5. Assessing the Impact of Covid-19 on Stock Markets Worldwide: stock market performance during the Covid-19 pandemic.

To identify firms for analysis, we will examine those with higher levels of AGR operating income, gross margin, quick ratio, and ROI, while also having lower levels of debt to assets and receivable turnover. Our analysis results will be compared to established models. The impact of stock price factor valuation on predicting future stock returns has been significantly affected by stock price changes. However, in the short-term, stock price movements are not significantly affected by this factor. Our method selects profitability (return on assets), liquidity (quick ratio), and solvency (debt to assets) metrics, as well as the method proposed by Edirisinghe and Zhang (2008). In times of crisis, a liquidity crunch may prevent a firm from accessing credit, making a firm with sufficient cash and less debt more likely to survive and less likely to have to liquidate valuable assets at unfavourable prices, making it a safer and more appealing investment for investors. However, we did not select earnings per share or capital intensity metrics, as they have reduced predictive power in the short-term during a lockdown, when a company's revenue structure and capital allocation are significantly altered.

VII. IMPLEMENTATION

The subprime crisis predicted the decline in equities during the subprime crisis through asset-backed securities (ABS) market shocks (Khan & Park, 2009). Banks' exposure to packaged subprime loans resulted in bank failures in the United States and Europe, leading to a global decline in stock prices. The Eurozone crisis was primarily caused by balance-of-payments concerns, which worsened when EU nations were unable to devalue their currencies. This crisis resulted in several stock markets worldwide experiencing a decline. The Covid-19 pandemic led financial economists to predict unprecedented geo-economic challenges, and equity markets experienced high implied volatility due to investors' flight to

safety. Our research indicates that the subprime crisis was the most contagious for Asian stock markets (Brunnermeier & Pedersen, 2009; Allen & Gale, 2009), with a direct impact on multiple channels of financing and liquidity. Consequently, the liquidity contagion morphed into a stock market contagion. Due to the greater integration of Asian stock markets with the global stock market, particularly in the USA in 2007, than they were in 1997 (Park, 2013), this crisis had a greater impact than the Asian crisis.

Therefore, the US subprime crisis may have been associated with a greater flight to quality than the Asian crisis. According to Mohti *et al.* (2019), the outbreak of the Eurozone debt crisis caused an epidemic that was confined to the most affected regions under the euro's significant economic influence, resulting in a decoupled stock market and negative contagion (Mohti *et al.*, 2019). As a health crisis, the Covid-19 pandemic also affected the real sector due to a mismatch between supply and demand during its development in waves. Economic activity increased as lockdown conditions were eased in each country, allowing companies to manage profitability and reduce costs. Consequently, the stock market did not factor it in. The present study's analysis of contagion has several implications for investors and policymakers because the Covid-19 pandemic had a less significant impact on stock markets than the subprime liquidity crisis, which gradually manifested. The recurrence of contagion highlights the need for policymakers to improve fundamentals, such as reducing information asymmetry, to ensure market recovery. If the market depreciates due to panic, policymakers should endeavour to calm market sentiment.

VIII. DISCUSSION

The corporation in question is engaged in the sale of goods and provision of services. Gross margin is an essential metric that reveals the proportion of revenue that a company retains after accounting for the cost of goods sold. The growth in operating income is indicative of a company's enhanced profitability over a given period, whereby expenses such as wages, depreciation, and cost of goods sold are deducted from the organization's revenue to determine its profit. Improved operating income growth may reflect cost-saving measures and greater operational efficiency, thus attracting potential investors. Moreover, the growth rate of both the quick ratio and the debt-to-assets ratio serves as a proxy for a firm's financial leverage. The quick ratio is obtained by dividing the company's current liabilities by its liquid assets, which refers to assets that can be rapidly converted into cash without affecting their market price.

TABLE I: SUMMARY STATISTICS FOR THE DATA (WHO DECLARED WORLDWIDE PANDEMIC MARCH 11, 2020)

Index	Mean	Median	Std. Dev.	Skewness	Kurtosis	P5	P95
AAPL	94.55287	89.8817	39.56962	0.143122	-1.36271	41.97534	150.6726
GOOGL	85.81801	73.955	30.12752	0.83834	-0.71377	54.989	144.3178
AMZN	130.1886	144.225	35.94875	-0.07816	-1.75585	83.53037	175.239
MSFT	195.0022	196.5871	65.30707	0.445157	-0.79933	106.9447	322.6263
TSLA	124.6283	77.60966	110.0516	0.598092	-0.92703	14.90633	336.3017
BRK-A	343413.9	326756	53355.96	0.556212	-0.96919	271630	434535
JPM	116.2545	108.2984	25.56059	0.413587	-1.28201	85.2248	158.182
V	190.8168	193.1327	27.27969	-0.18554	-0.70942	142.8162	231.649

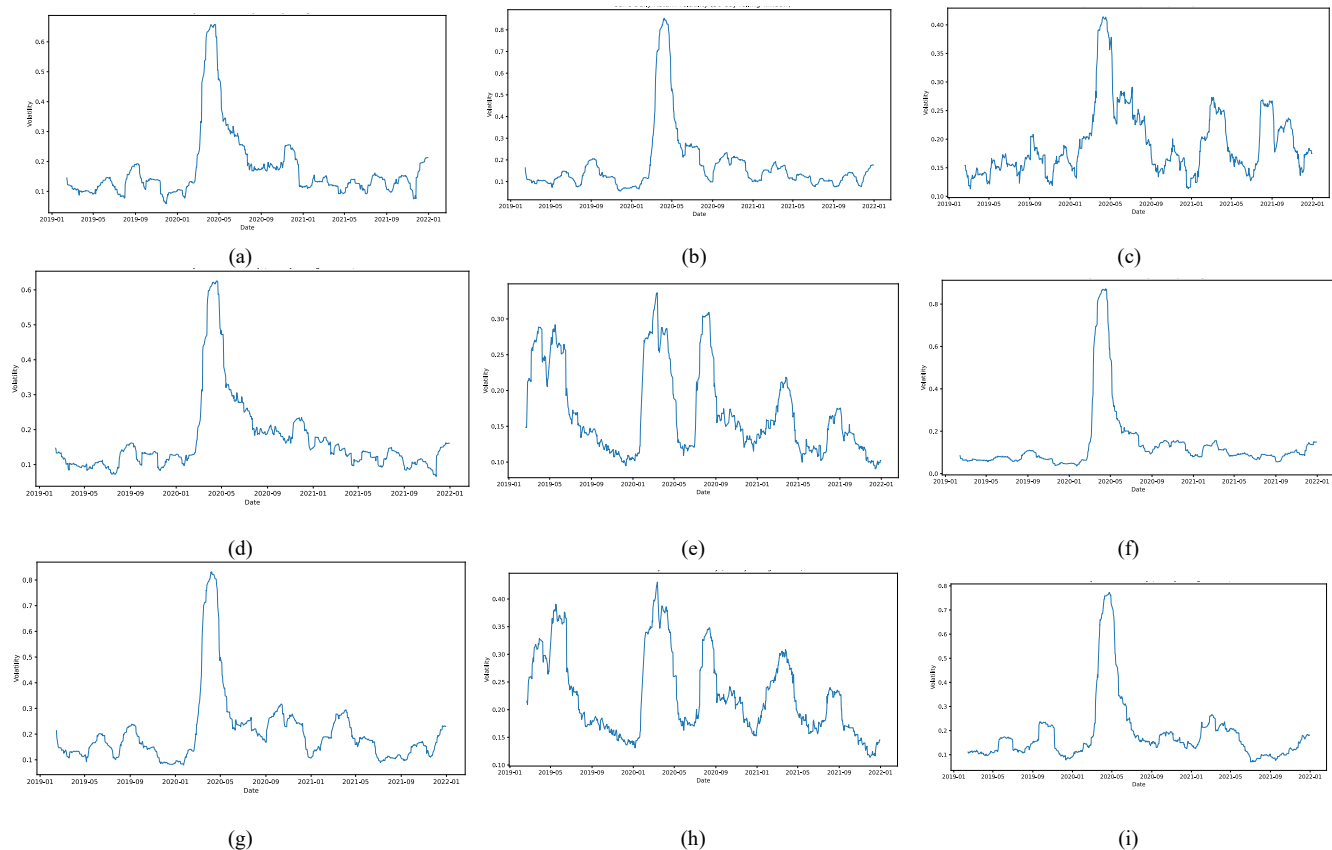


Fig. 6. Comparative Analysis of Stock Return Volatility Across Global Market: a) N100 Daily Return Volatility (30-day rolling window); b) GSPC Daily Return Volatility (30-day rolling window); c) HIS Daily Return Volatility (30-day rolling window); d) FTSE Daily Return Volatility (30-day rolling window); e) 000001.SS Daily Return Volatility (30-day rolling window); f) GSPTSE Daily Return Volatility (30-day rolling window); g) IXIC Daily Return Volatility (30-day rolling window); h) 399001.SZ Daily Return Volatility (30-day rolling window); i) BSESN Daily Return Volatility (30-day rolling window).

Consequently, a high quick ratio indicates that the enterprise has adequate resources to meet its immediate obligations. On the other hand, the debt-to-assets ratio reflects the total debt that a company has compared to its assets, thereby revealing the company's financial stability.

During a recession, a firm that maintains a higher quick ratio or a lower debt to assets ratio may be more likely to endure. This is because acquiring loans to pay off debts becomes difficult. Additionally, the receivable turnover ratio is a measure of a company's effectiveness in collecting payments from customers or clients. This metric reveals how efficiently companies utilize their credit and how promptly they settle their short-term obligations.

Inadequate client prepayments can negatively impact net credit sales, which is directly linked to receivable turnover. Negative receivable turnover indicates that a firm is less susceptible to credit risk from third parties since it has already received payment from the client before providing the service. During times of liquidity crisis, clients may default or delay payments. Therefore, a company with a negative receivable turnover ratio would be desirable. During a pandemic-induced financial crisis, the results of this analysis could serve as a reference when selecting a stock portfolio. Typically, the healthcare sector has the most significant direct effect on stock returns, followed by consumer defensive, communication service, utility, and technology.

IX. CONCLUSION

Daily returns are the percentage change in the price of an asset from one day to the next. They are calculated by taking the current day's closing price, subtracting the previous day's closing price, and dividing the result by the previous day's closing price.

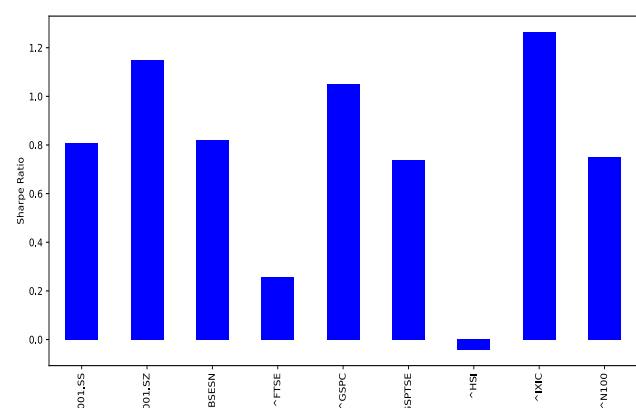


Fig. 7. Sharpe Ratios for Each Index.

$(R_p - R_f) / \sigma_p$ measure of risk-adjusted return. It is calculated by dividing the excess return (the return above the risk-free rate) by the standard deviation of returns. A higher Sharpe ratio indicates a better risk-adjusted return.

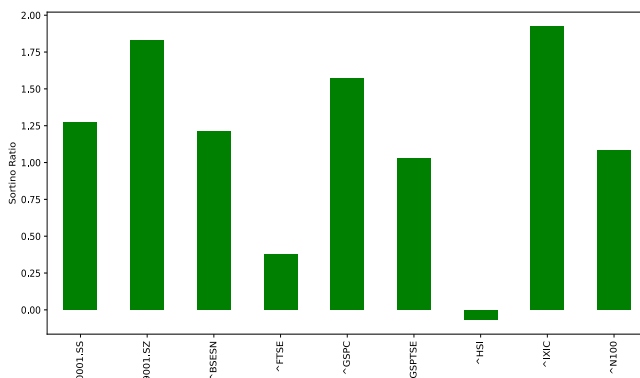


Fig. 8. Sortino Ratios for Each Index.

Volatility is a statistical measure of the dispersion of returns for a given security or market index. It is often used as a measure of risk, as assets with higher volatility are generally considered to be riskier than those with lower volatility. $SortinoRatio = (R - T)/D$ is a measure of risk-adjusted return that takes into account only downside risk. It is calculated by dividing the excess return (the return above the minimum acceptable return) by the downside deviation of returns. A higher Sortino ratio indicates a better risk-adjusted return that has been achieved without incurring too much downside risk.

Alpha is a measure of the excess return of a portfolio or asset compared to its expected return, given its level of risk. It is often used as a measure of a manager's skill in generating returns beyond what would be expected based on the risk of the portfolio or asset. A positive alpha indicates that the portfolio or asset has outperformed its expected return, while a negative alpha indicates underperformance.

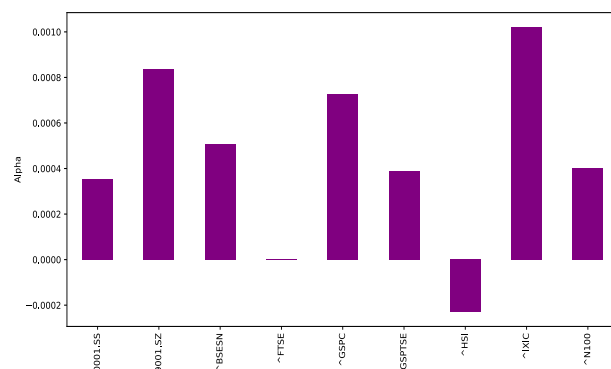


Fig. 9. Alpha for Each Index.

A comparative approach to studying contagions can assist policymakers and regulators in developing diverse strategies to prevent and safeguard economies against various economic factors, thereby minimizing the frequency and intensity of financial crises. Drawing on past experiences and mistakes, institutions, policies, and market regulations must be enhanced to reduce the frequency and severity of financial crises. Furthermore, foreign investors, who have experienced the least impact during the four crises, can potentially use these findings as a framework for selecting stock markets for diversification.

Understanding the risks associated with a herding strategy when investing globally necessitates comprehending how portfolio allocation and rebalancing can propagate a crisis to other markets. This paper presents an alternate viewpoint on

the relationship between stock markets as a result of contagion across crises with varying economic implications. Further research is necessary to determine the extent to which Covid-19 is contagious. Given that Covid-19 research is in its nascent stages, when longer-term data becomes available regarding the pandemic's severity, we will be better positioned to make conclusions regarding its severity. In addition to Asian markets, this study's scope can be broadened to encompass other markets, allowing for a comparison of markets worldwide and further strengthening of our findings.

In future study considering analyzing the impact of the Covid-19 pandemic on selected stock market indices. We found that the pandemic had a significant impact on the stock market, with sharp declines observed in the early stages of the pandemic. However, the stock markets eventually recovered, with some even surpassing pre-pandemic levels. Our analysis also revealed variations in the impact of the pandemic across different stock markets, with some being more resilient than others highlights the importance of considering the impact of external events on the stock market and the need for investors to diversify their portfolios to minimize risk.

AUTHOR CONTRIBUTION

Conceptualization, Methodology, Software, Formal Analysis, Visualization, Funding acquisition, Writing - Original Draft, M.A.N.U; Investigation, Formal analysis, Supervision, S.M; Formal analysis, Visualization, Writing - review & editing, A.O.H, and F.A.J.O. The study was designed, data was collected, analyzed, and the article was prepared for submission by all authors. Furthermore, all authors have carefully read and agreed to the final version of the manuscript published in this journal.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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