The Impact of the COVID-19 Pandemic on metal, mining, and allied sectors in the Indian Stock Market

Manmohan
University of Delhi, Delhi, India
Email: manmohankaushik12@gmail.com

Abstract

The paper investigates the effect of the first and second waves of COVID-19 on metal, mining, and its associated sectors stocks in India. Furthermore, the paper explores how the share price of the Indian metal, mining, and allied sectors is impacted and how it differs from the rest of the market. We also compare the effect of the pandemic waves on share prices related to metal, mining, and associated sectors in India during the study period, which ranges from January 2020 to December 2021. The share prices are collected from CMIE prowess for the sample firms. We use event study methodology to explore the impact of the different waves on the above-mentioned sectors. The finding exhibits that the first wave of the pandemic was more extreme in terms of the adverse price reaction than the second wave of the pandemic in the short term in the first five days. In the first wave, a more negative impact was on the Nifty50 index than the metal index. The firms in the metal and allied sectors experienced more negative price reactions than the metal index on the announcement of the lockdown event in the first wave. In the second wave, the impact was less than experienced by the firms in the first wave. We present the comparative empirical findings in daily and period-wise frequency to understand the effect of the 1st and 2nd waves of the pandemic on metal, mining, and its associated sectors in India. Our paper will contribute to the literature on extreme events and assist different stakeholders.

Keywords: *COVID-19; Event study; Sectoral Analysis; Extreme events; India.*

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1. Introduction

The COVID-19 pandemic increases the attraction of researchers toward extreme events. The events that are not recurring are referred to as extreme events—for instance, the financial crisis, tax reforms, and COVID-19. There is a vast literature on COVID-19 and the stock prices in different countries. However, limited attention is paid to the sector-specific impact of COVID-19. In addition, the extant literature is focused more on the first wave of COVID-19. Hence, our concern in this paper is narrow and limited to a specific sector, the metal sector in India.

The metal sector is one of the key contributors to India's manufacturing and GDP. In India, after the economic reform of 1991, the economy was integrated into the world economy. Hence, financial markets are also more impacted by global events. The metal sector in India plays a pivotal role in the country's economy, contributing significantly to industrial growth, infrastructure development, and job creation. The metal sector, encompassing steel, aluminum, copper, and other metals, serves as a foundation for various industries. Steel, in particular, is crucial for construction, automotive, machinery, and infrastructure development. In addition, the waste management initiatives taken by the metal and mining firms also add to the sustainable development of India (Posti et al., 2023). Further, the sector significantly contributes to India's Gross Domestic Product (GDP). The production and sale of metals, both domestically and internationally, have a notable impact on the country's economic output.

Furthermore, India's metal sector attracts foreign investment and plays a crucial role in international trade. It exports metals to various countries and participates actively in global trade networks. The Indian government recognizes the importance of the metal sector and has implemented policies and initiatives to support its growth. Overall, the metal sector in India

holds a strategic position in the country's economic landscape, driving industrial development and infrastructure growth and contributing significantly to employment and GDP.

Globally, there are various contexts in which researchers study the impact of extreme events such as financial recessions, terrorist attacks, and epidemics on the financial market. For instance, Al-Rjoub (2011) and Al-Rjoub and Azzam (2012) studied the effect of the Iraq war and the great recession of the US in 2008 on the financial markets. Righi and Ceretta (2011) studied the impact of the European crisis, which led to higher volatility in affected countries. Goh and Law (2002) suggest that during the outbreak of the Asian financial crisis, stock prices experienced a negative impact, especially on the tourism industry. Further, Schwert (2011) and Rengasamy (2012) examined the impact of the US financial crisis and Eurozone sovereign policy announcements on different financial markets.

Moreover, Nikkinen et al. (2008) and Al Rjoub (2009) investigated the impact of the 9/11 terrorist attack and different financial meltdowns on the global financial market. In addition, vast literature studies the impact of health emergencies such as influenza and SARS pandemics on the stock market in different country contexts. For instance, Goh and Law (2002) study the impact of the Hong Kong avian influenza outbreak. Mctier et al. (2011) conclude that with an increase in the spread rate of flu, there is a reduction in trading activities in the US financial market. Some studies examine the impact of the latest COVID-19 outbreak on the financial market (Iyke, 2020a). Narayan and Phan (2020) investigate the impact of COVID-19 on the various capital markets across the globe. Furthermore, we find few studies that investigate the effect of COVID-19 on the industry context. Several studies study the impact of extreme events on individual industries. Kumar et al. (2021) investigate the impact of COVID-19 on the Indian financial market and specifically provide evidence of the industry-wide impact of the pandemic.

The academicians are interested in exploring the price reaction to the occurrence of an event globally. Most of the existing literature is based on developed markets, and literature is scarce in the context of emerging economies. India is one of the largest emerging economies in the world (Garten, 1997). Therefore, In this paper, we investigate the stock price reaction of the firms working in the metal and its allied sectors on the announcement of the different waves of the pandemic. In addition, we also compare the market reactions to the different waves of the pandemic for the firms engaged in metal and allied sectors. We individually investigate the impact of different pandemic waves on Nifty50 index firms, Metal Index firms, and metal and allied firms. We compare the stock price reaction of different firms and discuss the impact of each of the two waves in India.

The finding exhibits that the first wave of the pandemic was more extreme in terms of the negative price reaction than the second wave of the pandemic in the short term, in the first five days. In the first wave, a more negative impact was on the Nifty50 index than the metal index. The firms working in the metal and allied sectors experienced more negative price reactions than the metal index on the announcement of the lockdown event in the first wave. On the contrary, the second wave Nifty50 index experiences a negative price reaction, whereas the metal index experiences a positive price reaction. The firms working in the metal and allied sectors experienced more positive price reactions than the metal index on the announcement of the lockdown event in the second wave.

This paper contributes to the literature on extreme events. The findings will assist different stakeholders such as shareholders, creditors, policymakers, top management, and the rest of others in making their respective financial decisions. Finally, findings also help exchanges and market regulators make their respective relevant decisions in the interest of the shareholders by reducing market manipulations and panic during extreme events.

The rest of the paper is divided into the following sections. Section 2 discusses the literature review. Section 3 describes the data and methodology. Section 4 discusses the results section, and finally, we conclude the paper in Section 5.

2. Literature Review

Across the globe, researchers delve into the multifaceted impacts of significant events like financial downturns, terrorist attacks, epidemics, and other disruptive occurrences on financial markets. Take, for instance, the work of Al-Rjoub (2011) and Al-Rjoub & Azzam (2012), who scrutinized the effects of the Iraq war, the 2008 US recession, and even the Mexican tequila crisis on financial markets, with a specific lens on the Jordan Stock Exchange. Similarly, Righi and Ceretta (2011) undertook an analysis of the European debt crisis, uncovering heightened volatility in countries like Britain and Germany. Goh and Law (2002) observed the detrimental impact of the Asian financial crisis on stock prices, particularly within the tourism sector. Delving deeper, Schwert (2011) and Rengasamy (2012) delved into the repercussions of the US financial crisis and Eurozone policy pronouncements on diverse financial markets. Furthermore, Nikkinen et al. (2008) and Al Rjoub (2009) explored the ramifications of the 9/11 terrorist attacks and various financial crises on the global financial landscape.

Lanfear et al. (2018) studied the impact of hurricanes on the US financial market. The authors provide evidence that hurricanes impact consumer growth rates. Yin et al. (2020) conducted a study examining the trade war's impact on the Chinese context. The authors suggested that the US-China trade war negatively impacts the firms listed on stock exchanges in China. Pandey et al. (2023) concluded in their recent study that climate pacts have an impact on energy stock. Rai and Kumari (2021) investigated the impact of COVID-19 on the volatility of cryptocurrencies. Similarly, Pandey et al. (2022) explore the impacts of corporate announcements on stock returns during the global pandemic in the Indian context.

In addition, a vast literature studies the impact of health emergencies such as influenza and SARS pandemics on the stock market in different country contexts. For instance, Goh and Law (2002) study the impact of the Hong Kong avian influenza outbreak. Mctier et al. (2011) conclude that with an increase in the spread rate of flu, there is a reduction in trading activities in the US financial market. Chen, Jang, and Kim (2007), with a country context of China and four other countries, explore the long-term effect of SARS. The authors provide evidence that the SARS outbreak has impacted the integration level of these markets. Existing studies study the impact of the latest COVID-19 outbreak on the financial market (Iyke, 2020a). Narayan and Phan (2020) investigate the impact of COVID-19 on the various capital markets across the globe. Further, Pandey and Kumari (2020) examined the impact of COVID-19 on the 43 capital markets worldwide and suggested that the pandemic negatively impacted the market.

Furthermore, few studies explore the impact of extreme events on the industry context. Several studies study the impact of extreme events on individual industries. Ragin and Halek (2016) examine the role of disasters in the determination of the stock returns for a firm associated with the insurance sector. The authors have examined the effect of the 43 largest disasters on the insurance sector and suggested a negative impact on the occurrence of disasters. Chen et al. (2007) examine the impact of the SARS virus with specific reference to the hotel industry. The authors have selected Taiwan for their study and suggested that the outbreak of the SAS virus inversely impacts stock prices. Kumar et al. (2021) investigate the impact of COVID-19 on the Indian financial market and specifically provide evidence of the industry-wide impact of the pandemic. Further, Pandey and Kumar (2021) examined the impact of COVID-19 on the Indian tourism sector with a sample of 29 firms. Kumari et al. (2022) provided evidence in their study that there is a negative impact of COVID-19 stocks on aviation stocks. Some studies argue that during the pandemic, investors tried to shift their portfolio from equity to precious metals to safeguard the capital and generate returns from the capital

appreciation of the precious metals (Lahiani et al., 2021; Kangalli et al., 2022; Umar et al., 2021).

The above-mentioned studies examine the impact of extreme events and provide evidence of the investors' reactions to them. With the knowledge in hand, we could not find any study specifically dealing with metal, mining, and its associated sectors and how these sectors reacted to the extreme events mentioned above. Our study bridges the gap in the existing literature by exploring the impact of 1st and 2nd COVID-19 waves on the Metal, Mining, and its Associated Sectors.

We have employed the event study methodology to explore the impact of different waves of COVID-19 on the metal sector. It is a widely used method in the finance literature to explore the price impact on the occurrence of events. Researchers are interested in investigating the share price as it is one of the indicators of the shareholder's wealth (Kumar et al., 2021; Assaf et al., 2023). Recent literature on the event study includes Rai et al. (2021) and Rai et al. (2022), who explored the impact of privatization and mergers on the stock prices specific to the banking sector. Similarly, Gupta et al. (2022) investigate the impact of spin-offs on stock prices in the Indian context. Further, Kumar and Chakrabarti (2022) explore the impact of derivatives listing (delisting) on stock prices and conclude that on derivatives listing (delisting), there is a positive (negative) impact on stock prices. Along similar lines, Pandey and Kumar (2022) used the event study methodology to investigate the impact of the Russia-Ukriane war on global tourism stocks. Kumar et al. (2023) explored the impact of layoffs on the stock prices of the firms and suggested that on layoff announcements, stock prices experienced negative price reactions.

3. Data and Methodology

3.1 Data

The preliminary cases of the pandemic were reported in China during the last three months of 2019. In China, the first case was found in Wuhan province. In India, the cases emerged in early 2020. The government of India started to take lockdown measures in late March 2020. The lockdown measures were taken to curtail the infection across the country. Thus, the announcement of the lockdown in India is taken as the event date. The sample firms for our study are Nifty50 firms. In addition, the sample firms comprise metal, mining, and allied sector firms. In this paper, a firm with inconsistent data has been removed from our study. In addition, firms whose data is unavailable are also removed.

Our final sample comprises 50 firms for the Nifty50 index, 13 in the metal index, and 98 in the metal, mining, and allied sectors. The securities prices for each firm are obtained from CMIE prowess on a daily basis. The study period is from January 2019 to December 2021. The Nifty50 index is used to calculate the market returns.

We conduct three different event studies for 1st and 2nd waves separately. We take 24th March 2020 and 20th April 2021 as our event days for the first and second waves of COVID-19. The first event study helped in investigating the impact of the pandemic on the overall market through the Nifty50 Firms. Next, another event study is used to capture the price impact of the pandemic on the metal index through the Nifty Metal Index. Finally, we conducted the last event study to investigate the effect of the pandemic on the stock prices of metal, mining, and its allied sectors.

3.2 Methodology

This paper focuses on investigating the impact of the 1st and 2nd waves of the pandemic on metal, mining, and its associated sectors in India. Furthermore, we explore the extent to which the impact on the Indian metal, mining, and its allied sectors is different from the rest of the market. We also compare the price effect of the pandemic waves on metal, mining, and associated sectors in the Indian context during the study period, which ranges from 2020 to

2021. We use the above-mentioned study period to investigate the price effect of different waves on metal, mining, and its associated sectors and markets in India.

In this paper, we use the standard event study methodology. This methodology is proposed by (Brown and Warner, 1980; Brown and Warner, 1985). Researchers have to first identify the event date for conducting the event study. Next, finalize the event window and estimation period. The event day is the day on which the news for the different waves reaches the public. We take 200 days as an estimation period. The event window comprises 21 days. The event window includes the event day, ten days before and after the event day. We have used the market model for calculating the normal market returns. Alternatively, it can be calculated using fama factor models (Fama and French, 1996; Fama and French, 2015; Fama and French, 2017)

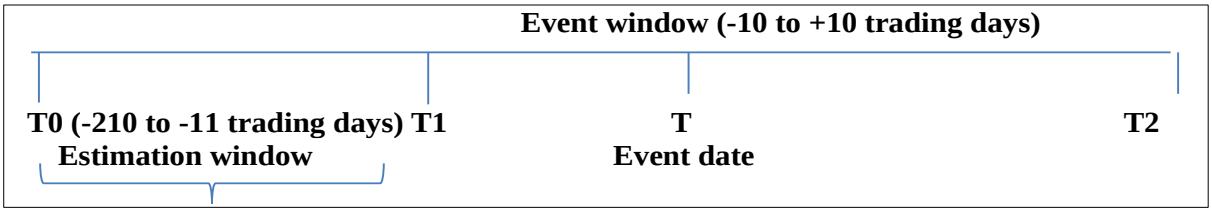

Figure 1. Classification of timeline

3.2.1. Steps in estimating the abnormal return

Step1: The Expected Return (ER) is estimated using the most widely used market model, wherein the benchmark return is the NIFTY50 return.

$$ER_{it} = \alpha + \beta R_{mt} \quad (1)$$

where, R_{mt} is the daily return of the Nifty 50 index.

Step2: Actual Stock Return

$$R_{\mathrm{it}} = \ln\left(P_{\mathrm{it}}/P_{\mathrm{it-1}}\right) \quad (2)$$

where, $R_{\mathrm{it}}$is the daily return of the stock i

$P_{\mathrm{it}}$is the price of the stock i on day t

$P_{it-1}$is the price of the stock I on one day before day t

Step 3: Abnormal Return

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

Step 4: Average Abnormal Return (AAR)

$$AAR_{\mathrm{t}} = \frac{1}{N}\sum_{i=1}^{N} AR_{\mathrm{it}} \quad (4)$$

Step 5: Cumulative Average Abnormal Return (CAAR)

$$CAAR_{\mathrm{p}} = \sum_{i=1}^{p} AAR_{\mathrm{it}} \quad (5)$$

4. Findings

We present the impact of the 1st and 2nd waves on the Nifty50 companies in Tables 1 and 2. We find that 1st wave has a more negative impact than 2nd wave on Nifty50 companies, with more than 3% negative abnormal return in the first five days after the announcement of the pandemic. In addition, we do not find any significant impact on the Nifty50 firms during 2nd wave of the pandemic. However, we provide evidence that in 1st wave, the negative impact continued for ten days after the announcement of the pandemic. In Figure 2, we have provided the daily-wise CAARs and AARs for Nifty50 firms on the announcement of the first and second waves of COVID-19. Markets might have already priced in the potential for a second wave.

There are various reasons for the lower impact of the second wave of COVID-19 on the stock markets as compared to the first wave. First, investors may have adjusted their

expectations and strategies based on the likelihood of future waves of the pandemic. Second, governments and central banks around the world have implemented various measures to support economies during the pandemic. Fiscal stimulus packages, monetary policy interventions, and vaccination efforts can influence market sentiment and offset some of the negative economic impacts of a second wave. Third, investor sentiment can play a crucial role in market movements. If investors believe that the worst is behind them or that the impact of the second wave will be limited, they may remain optimistic and continue to invest in stocks. Last, the valuations of stocks are influenced by a wide range of factors, including earnings expectations, interest rates, and risk perceptions. Market valuations may already reflect expectations about the future course of the pandemic.

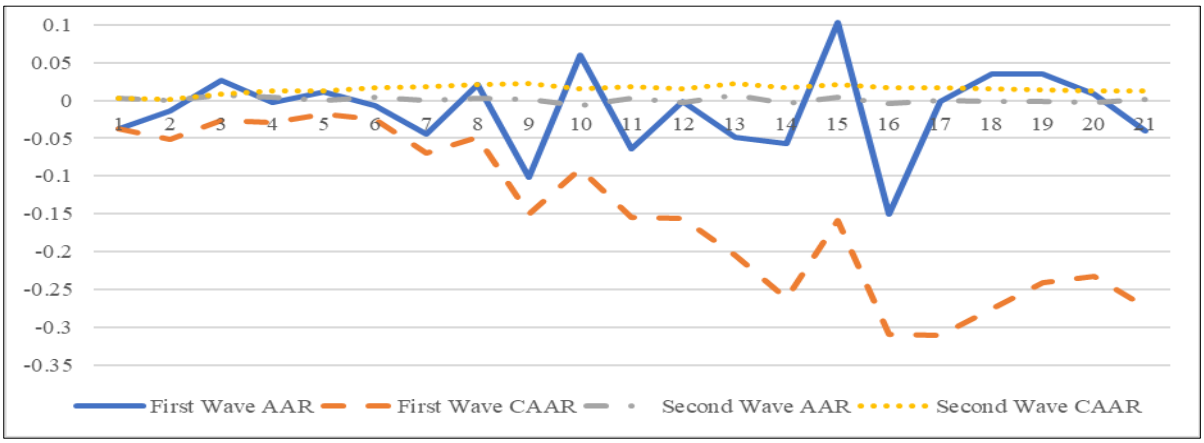

Figure 2. Daily CAARs and AARs for Nifty50 firms on announcement of first wave COVID-19

Table 1. Daily AARs and CAARs for firms in the Nifty50 index on the announcement of the first and second waves of COVID-19

	First Wave				Second Wave			
Days	**AAR**	**t-stats**	**CAAR**	**t-stats**	**AAR**	**t-stats**	**CAAR**	**t-stats**
-10	-0.037***	-7.651	-0.037**	-2.307	0.002	0.892	0.002	0.269
-9	-0.014***	-2.952	-0.051***	-3.353	-0.001	-0.223	0.002	0.212
-8	0.026***	5.296	-0.025*	-1.769	0.006***	2.566	0.008	1.078
-7	-0.003	-0.685	-0.029**	-2.119	0.00475*	1.878	0.013*	1.808
-6	0.011**	2.192	-0.019	-1.437	0.000	0.081	0.013**	1.963
-5	-0.007	-1.355	-0.025**	-2.105	0.004	1.619	0.017***	2.781
-4	-0.044***	-9.084	-0.069***	-6.368	0.000	0.17	0.017***	3.123
-3	0.020***	4.184	-0.049***	-5.028	0.003	1.3	0.020***	4.141
-2	-0.101***	-20.651	-0.150***	-17.729	0.001	0.36	0.021***	4.99
-1	0.059***	12.141	-0.090***	-13.129	-0.0067***	-2.683	0.015***	4.214
0	-0.064***	-13.145	-0.155***	-31.712	0.003	1.253	0.0182***	7.213
1	-0.001	-0.213	-0.156***	-22.574	-0.003	-1.143	0.015***	4.292
2	-0.048***	-9.919	-0.204***	-24.158	0.006**	2.515	0.021***	4.956
3	-0.057***	-11.679	-0.262***	-26.761	-0.004*	-1.728	0.017***	3.428
4	0.102***	20.994	-0.159***	-14.547	0.004	1.418	0.020***	3.7
5	-0.150***	-30.679	-0.309***	-25.804	-0.004*	-1.707	0.016***	2.681
6	-0.001	-0.225	-0.310***	-23.975	0.000	0.07	0.016**	2.509
7	0.034***	7.015	-0.276***	-19.946	-0.001	-0.361	0.015**	2.219
8	0.035***	7.162	-0.241***	-16.418	-0.001	-0.53	0.014*	1.916
9	0.008*	1.808	-0.232***	-15.004	-0.002	-0.95	0.012	1.517
10	-0.040***	-8.294	-0.272***	-16.806	0.001	0.443	0.013	1.58

Notes: This table presents day-wise event study results for average abnormal returns and cumulative average abnormal returns for firms that constitute the Nifty50 index. The comparative results are provided for both the first and second waves for comparability and easy understanding

Further, we present the impact of the 1st and 2nd waves on the metal index companies in Tables 3 and 4. In Table 3, we provide daily AARs and CAARs. The metal index firms experienced the highest adverse abnormal returns of more than 5% on day +4 and 2% on day

+6 in the 1st and 2nd waves of the pandemic, respectively. In Table 4, we provide period-wise AARs and CAARs. We find that 1st wave has a more negative impact than 2nd wave on metal index companies, with more than 2% negative abnormal return in the first five days after the announcement of the pandemic. In addition, we provide evidence that in the 2nd wave metal index, firms experienced positive abnormal returns. In Figure 3, we have provided the daily CAARs and AARs for firms in the metal index on the announcement of the first and second waves of COVID-19.

Table 2. Period-wise AARs and CAARs for firms in the Nifty50 index on the announcement of the first and second waves of COVID-19

	First Wave				Second Wave			
Windows	**AAR**	**t-stats**	**CAAR**	**t-stats**	**AAR**	**t-stats**	**CAAR**	**t-stats**
(-10,-5)	-0.004	-0.859	-0.025**	-2.105	0.003	1.135	0.017***	2.781
(-5,-1)	-0.014**	-2.953	-0.072***	-6.603	0.000	0.153	0.002	0.343
(-3,-1)	-0.007	-1.442	-0.021**	-2.498	-0.001	-0.341	-0.003	-0.590
(-1,0)	-0.002	-0.502	-0.005	-0.710	-0.002	-0.715	-0.004	-1.011
(-1,+1)	-0.002	-0.406	-0.006	-0.703	-0.002	-0.858	-0.006	-1.486
(0,+1)	-0.032***	-6.679	-0.065***	-9.445	0.000	0.055	0.000	0.077
(+1,+3)	-0.035***	-7.270	-0.106***	-12.592	0.000	-0.119	-0.001	-0.206
(+1,+5)	-0.030***	-6.299	-0.154***	-14.085	0.000	-0.129	-0.002	-0.288
(+5,+10)	-0.018***	-3.869	-0.113***	-9.476	-0.001	-0.506	-0.008	-1.239

Notes: This table presents event study results period-wise for average abnormal returns and cumulative average abnormal returns for firms that constitute the Nifty50 index. The comparative results are provided for both the first and second waves for comparability and easy understanding.

Table 3. Daily AARs and CAARs for firms in the metal index on the announcement of the first and second waves of COVID-19

	First Wave				Second Wave			
Days	**AAR**	**t-stats**	**CAAR**	**t-stats**	**AAR**	**t-stats**	**CAAR**	**t-stats**
-10	-0.003	-0.475	-0.003	-0.143	0.031**	2.405	0.031	0.725
-9	-0.009	-1.281	-0.012	-0.555	0.015	1.119	0.046	1.114
-8	-0.008	-1.107	-0.020	-0.954	0.003	0.264	0.049	1.263
-7	-0.012*	-1.820	-0.032*	-1.655	0.005	0.394	0.054	1.478
-6	-0.031***	-4.557	-0.064***	-3.492	0.029**	2.285	0.083**	2.444
-5	0.009	1.341	-0.054***	-3.224	-0.008	-0.602	0.076**	2.394
-4	0.008	1.105	-0.047***	-3.038	-0.031**	-2.436	0.044	1.534
-3	0.035***	5.034	-0.012	-0.880	0.014	1.045	0.057**	2.237
-2	0.012*	1.852	0.001	0.054	0.000	0.007	0.058***	2.587
-1	0.043***	6.323	0.044***	4.537	0.000	-0.014	0.057***	3.159
0	-0.018***	-2.720	0.025***	3.696	-0.005	-0.392	0.052***	4.075
1	-0.025***	-3.656	0.000	0.029	0.006	0.441	0.058***	3.193
2	0.052***	7.573	0.052***	4.396	0.007	0.568	0.065***	2.935
3	-0.033***	-4.867	0.019	1.373	-0.002	-0.161	0.063**	2.461
4	-0.052***	-7.502	-0.033**	-2.127	0.011	0.820	0.074***	2.568
5	-0.034***	-4.948	-0.067***	-3.962	0.014	1.112	0.088***	2.798
6	-0.009	-1.250	-0.076***	-4.140	-0.020	-1.504	0.069**	2.022
7	0.029***	4.273	-0.046**	-2.362	0.031**	2.419	0.100***	2.747
8	-0.008	-1.079	-0.053***	-2.587	0.014	1.077	0.114***	2.949
9	0.028***	4.073	-0.026	-1.166	0.019	1.457	0.133***	3.258
10	0.012*	1.749	-0.014	-0.584	-0.011	-0.871	0.122***	2.844

Notes: This table presents day-wise event study results for average abnormal returns and cumulative average abnormal returns for firms that constitute the Nifty Metal index. The comparative results are provided for both the first and second waves for comparability and easy understanding

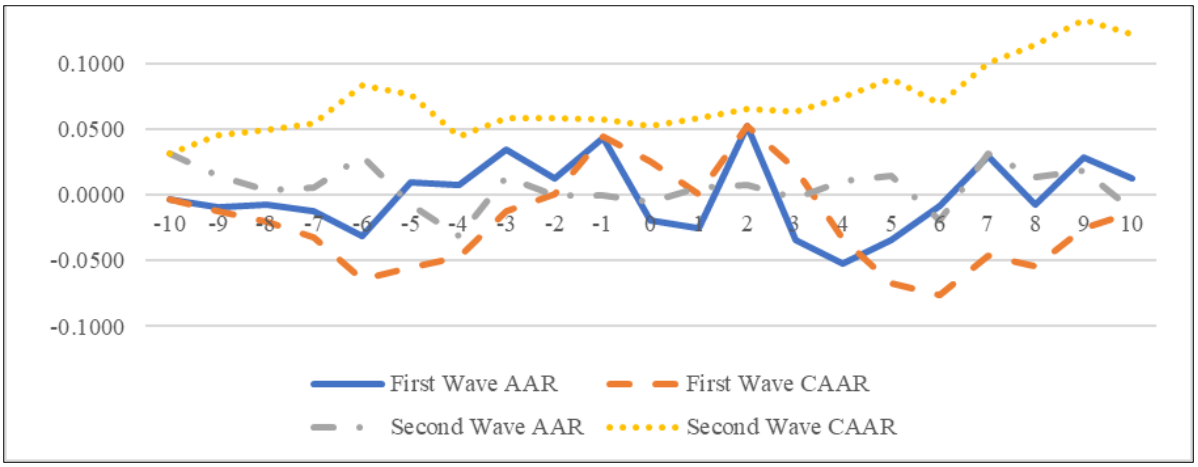

Figure 3. Daily CAARs and AARs for firms in Nifty Metal index on announcement of first and second waves of the COVID-19

Table 4. Period-wise AARs and CAARs for firms in the metal index on the announcement of the first and second waves of COVID-19

	First Wave				Second Wave			
Windows	**AAR**	**t-stats**	**CAAR**	**t-stats**	**AAR**	**t-stats**	**CAAR**	**t-stats**
(-10,-5)	-0.009	-1.316	-0.054***	-3.224	0.013	0.977	0.076**	2.394
(-5,-1)	0.021***	3.131	0.108***	7.001	-0.005	-0.400	-0.026	-0.894
(-3,-1)	0.030***	4.403	0.091***	7.627	0.005	0.346	0.013	0.599
(-1,0)	0.012*	1.802	0.025***	2.548	-0.003	-0.203	-0.005	-0.287
(-1,+1)	0.000	-0.018	0.000	-0.030	0.000	0.012	0.001	0.021
(0,+1)	-0.022***	-3.188	-0.044***	-4.508	0.000	0.025	0.001	0.035
(+1,+3)	-0.002	-0.317	-0.007	-0.549	0.004	0.283	0.011	0.489
(+1,+5)	-0.018***	-2.680	-0.093***	-5.993	0.007	0.556	0.036	1.243
(+5,+10)	0.003	0.470	0.020	1.150	0.008	0.615	0.048	1.506

Notes: This table presents event study results period-wise for average abnormal returns and cumulative average abnormal returns for firms that constitute the Nifty Metal index. The comparative results are provided for both the first and second waves for comparability and easy understanding.

Table 5. Period-wise AARs and CAARs for firms in the metal sector on the announcement of the first and second waves of COVID-19.

	First Wave				Second Wave			
Windows	**AAR**	**t-stats**	**CAAR**	**t-stats**	**AAR**	**t-stats**	**CAAR**	**t-stats**
(-10,-5)	-0.007*	-1.992	-0.042***	-4.879	0.014***	3.759	0.085***	9.207
(-5,-1)	0.003	0.867	0.015*	1.938	-0.005	-1.279	-0.024***	-2.859
(-3,-1)	0.012***	3.543	0.037***	6.136	0.002	0.538	0.006	0.932
(-1,0)	-0.002	-0.573	-0.004	-0.810	-0.008**	-2.200	-0.016***	-3.111
(-1,+1)	-0.013***	-3.859	-0.040***	-6.685	-0.003	-0.840	-0.010	-1.455
(0,+1)	-0.025***	-7.135	-0.050***	-10.090	-0.006	-1.432	-0.010**	-2.025
(+1,+3)	-0.013***	-3.808	-0.040***	-6.596	0.007**	2.024	0.023***	3.505
(+1,+5)	-0.022***	-6.251	-0.109***	-13.977	0.010***	2.697	0.051***	6.031
(+5,+10)	0.011***	3.373	0.071***	8.263	0.011***	2.893	0.066***	7.087

Notes: This table presents event study results period-wise for average abnormal returns and cumulative average abnormal returns for total firms that are engaged in the metal sector. The comparative results are provided for both the first and second waves for comparability and easy understanding. Period-wise AAR is calculated by dividing the CAAR by the number of days in each window.

Furthermore, we present the impact of the 1st and 2nd waves on the metal and allied companies in Tables 5 and 6. In Table 45, we provide daily AARs and CAARs. The metal index firms experienced the highest adverse abnormal returns of more than 4% on day +4 and 1% on event day in the 1st and 2nd wave of the pandemic, respectively. In Table 6, we provide period-wise AARs and CAARs. We find that 1st wave has a more negative impact than 2nd

wave on metal and allied companies, with more than 2% negative abnormal return in the first five days after the announcement of the pandemic. In addition, we provide evidence that in the 2nd wave metal index, firms experienced a positive abnormal return. In Figure 4, we have provided the daily CAARs and AARs for firms in the metal sector on the announcement of the first and second waves of COVID-19.

Table 6. Daily AARs and CAARs for firms in the metal sector on the announcement of the first and second waves of COVID-19

	First Wave				Second Wave			
Days	**AAR**	**t-stats**	**CAAR**	**t-stats**	**AAR**	**t-stats**	**CAAR**	**t-stats**
-10	-0.016***	-4.616	-0.016	-1.392	0.025***	6.754	0.025**	2.036
-9	-0.002	-0.662	-0.018*	-1.669	0.010***	2.652	0.035***	2.974
-8	-0.003	-0.928	-0.021**	-2.069	0.006	1.447	0.041***	3.618
-7	-0.009***	-2.626	-0.031***	-3.123	0.008**	2.322	0.050***	4.658
-6	-0.005	-1.482	-0.036***	-3.899	0.024***	6.523	0.075***	7.445
-5	-0.006	-1.636	-0.042***	-4.879	0.010***	2.857	0.085***	9.207
-4	-0.016***	-4.660	-0.058***	-7.428	-0.041***	-10.864	0.044***	5.228
-3	0.024***	6.943	-0.034***	-4.834	0.014***	3.694	0.058***	7.692
-2	0.004	0.994	-0.030***	-5.008	-0.009**	-2.424	0.049***	7.483
-1	0.009***	2.691	-0.021***	-4.230	0.001	0.344	0.050***	9.408
0	-0.013***	-3.836	-0.034***	-9.818	-0.018***	-4.744	0.032***	8.560
1	-0.036***	-10.433	-0.071***	-14.320	0.007*	1.880	0.039***	7.383
2	0.039***	11.166	-0.031***	-5.246	0.009**	2.450	0.049***	7.442
3	-0.042***	-12.158	-0.074***	-10.622	0.006*	1.741	0.055***	7.316
4	-0.049***	-14.080	-0.124***	-15.797	0.014***	3.813	0.070***	8.248
5	-0.020***	-5.748	-0.144***	-16.767	0.013***	3.603	0.083***	9.000
6	0.002	0.519	-0.142***	-15.327	0.000	0.054	0.084***	8.353
7	0.025***	7.139	-0.117***	-11.813	0.014***	3.830	0.098***	9.168
8	0.001	0.251	-0.116***	-11.054	0.015***	4.179	0.114***	10.036
9	0.042***	12.092	-0.071***	-6.663	0.028***	7.379	0.142***	11.855
10	0.021***	5.987	-0.053***	-4.548	-0.006*	-1.684	0.136***	10.795

Notes: This table presents day-wise event study results for average abnormal returns and cumulative average abnormal returns for total firms that are engaged in the metal sector. The comparative results are provided for both the first and second waves for comparability and easy understanding.

5. Conclusion

This paper investigates the impact of the first and second waves of COVID-19 on the Indian metal, mining, and allied sectors. Furthermore, we explore how the impact on the Indian metal, mining, and allied sectors differs from the rest of the market. We also compare the impact of the COVID-19 waves on the Indian metal, mining, and allied sectors during the study period, which ranges from 2020 to 2021.

The finding exhibits that the first wave of the pandemic was more extreme in terms of the negative price reaction than the second wave of the pandemic in the short term in the first five days. In the first wave, a more negative impact was on the Nifty50 index than the metal index. The firms working in the metal and allied sectors experienced more negative price reactions than the metal index on the announcement of the lockdown event in the first wave. Contrarily, in the second wave, the Nifty50 index experienced a negative price reaction, whereas the metal index experienced a positive price reaction (Kumar et al., 2021). The firms working in the metal and allied sectors experienced more positive price reactions than the metal index on the announcement of the lockdown event in the second wave.

The practical implications of our study can be far-reaching and can provide valuable insights for investors, policymakers, and industry stakeholders. Investors can use the findings of our paper to make more informed decisions about buying, selling, or holding metal sector stocks. Further, this paper helps in understanding how the sector reacted to specific COVID-

19 events and can help investors adjust their portfolios accordingly. Companies in the metal sector can use the findings to assess the vulnerabilities and risks associated with external shocks, such as a global pandemic. This information can be crucial for developing risk management strategies and contingency plans. Policymakers may use the results to inform economic policies and interventions. For example, if the study shows that certain types of support measures positively influence the metal sector, policymakers might consider similar interventions in the future during economic crises. Financial analysts can use the insights gained from this study to refine their valuation models for metal sector companies. This can improve the accuracy of financial forecasts and help analysts better understand the factors influencing company performance. The findings can contribute to academic research in finance and economics. They can also be used in educational settings to illustrate real-world applications of financial theories and concepts.

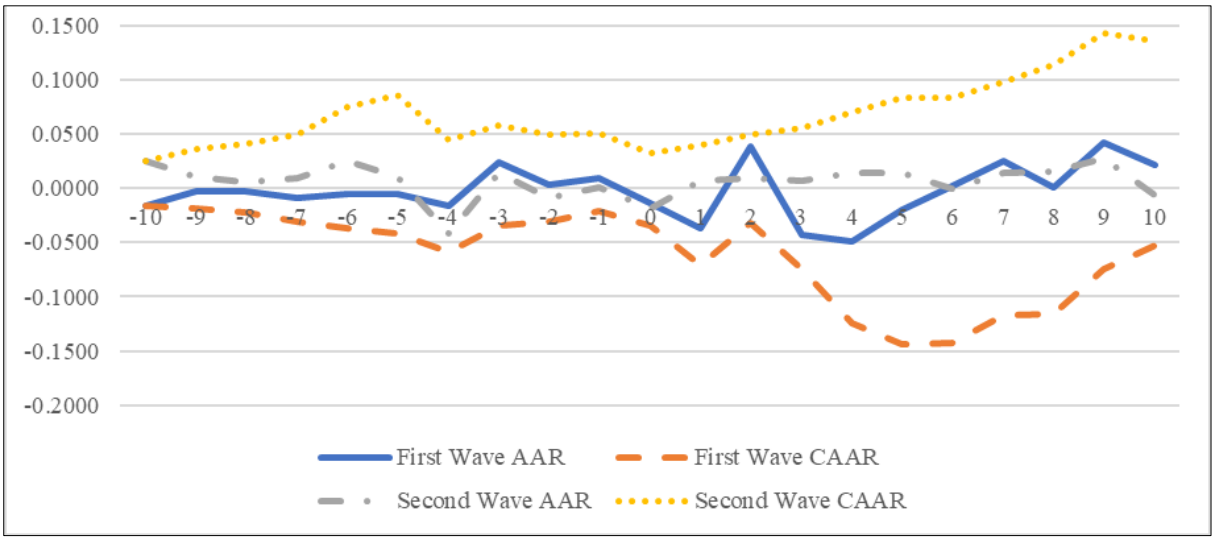

Figure 4. Daily CAARs and AARs for firms in metal sector on announcement of first and second waves of the COVID-19

In summary, the practical implications of an event study on the metal sector for COVID-19 are diverse and can influence decision-making at various levels, from individual investors to industry leaders and policymakers. The key is to translate the insights gained from the study into actionable strategies that enhance resilience and adaptability in the face of future challenges.

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