**Orissa Journal of Commerce**
Vol. 42, Issue 4, October-December 2021
ISSN: 0974-8482

*URL: www.ojcoca.org*
*DOI: https://doi.org/10.54063/ojc.2021.v42i04.01*

# Stock Market Dynamics with Respect to Advance-Decline Ratio in Pre and During Covid-19 Pandemic: An Empirical Analysis of S&P BSE Sensex

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**To cite this paper**

Mohapatra, S.P. (2021). Stock Market Dynamics with Respect to Advance-Decline Ratio in Pre and During Covid-19 Pandemic: An Empirical Analysis of S&P BSE Sensex. *Orissa Journal of Commerce.* 42(4), 1-11.

**Keywords**

Advance-decline ratio, Covid-19, S&P BSE Sensex, OLS regression

**JEL Classification**

G14, G17, G11, G02, G10

**Abstract:** The Indian stock market during the Covid-19 pandemic performed quite well in comparison to that of the pre-Covid period. Based on daily data from Bombay Stock Exchange, it was observed that the S&P BSE Sensex has grown by 85.5% from 1st April 2020 to 30th June 2021, while during a 9-year period from March 2011 to March 2020, the Index has grown by 59% only. To investigate further regarding this exceptional growth of stock market despite the Covid-19 pandemic, the advance-decline ratio (ADR) was also analyzed for the similar period. It was noticed that the daily average of ADR was 1.20 during the Covid-19 while it was only 1.03 during the last 9 years prior to the pandemic. The present study is focused on the impact of ADR on stock market return during Covid-19 as well as prior to the pandemic using regression analysis and to investigate the stock market response to overbought and oversold scenarios during Covid-19 pandemic.

## 1. Introduction

The stock market in India during the Covid-19 pandemic has performed much better despite the slowdown in the economy across the country. The Bombay Stock Exchange sensitive index S&P BSE Sensex has grown from 28265 on 1st April 2020, to 52448 on 30th June 2021, an increase of about 85.5%, while the market has grown by only 59.75% in the last 9 years of the pre-Covid period, in India i.e., from March 2011 to March 2020. So, the present study is an effort to know whether the performance of the stock market is backed by a strong movement of most of the stocks or only a few. It has been observed that the advance-decline ratio (ADR) on average is about 1.20 during the Covid period while it was1.03 for the last 9 years in the pre-Covid period. The ADR indicates a ratio of the number of stocks that have advanced to that of the number of stocks that have declined in comparison to the closing price of the previous trading day. ADR >1 means the stock price has increased for a greater number of stocks than that of stocks for which there is a price decline. ADR is an important indicator used by investors for technical analysis and it also refers to market breadth. ADR also indicates whether the market is overbought or oversold. ADR > 1 indicates more buying than selling and is hence called

an overbought condition and ADR<1 refers to more selling than buying and is thus called the oversold condition.

The stock market performance in any country is always regarded as one of the indicators of the status of the economy of that Nation. In simple words, the stock market index is called a barometer of any economy. There is also empirical evidence that the market behaves positively to the growth in GDP. But during the Covid period, the quarterly figure of GDP growth for India was on a declining trend. This may be because of a series of lockdowns, which was very much necessary then for health-related precaution. The lockdown has made many micro and small enterprises non-operatives because of workforce crisis and other resource constraints. This also has created lots of challenges for a few sectors like the Hotel and Tourism sector. However, for some phases of unlocks between the first and second wave of Covid, the economy was back into rails but the subsequent 2$^{nd}$wave of Covid situation again created further hindrance to the growing trend of the economy.

However, stock market in India has mostly been in a bullish trend during this pandemic except for an initial jerk at the announcement of the first lockdown in the country and a few momentary downfalls. Not only this, but the breadth of the market is also quite encouraging as measured in terms of advance-decline ratio (ADR). The number of stocks advancing in comparison to the number of stocks declining was also observed to be at the higher side most of the time. ADR is the ratio between the number of stocks whose share prices increased to the number of stocks whose share prices decreased on a particular trading day. During the Covid period from 1$^{st}$ April 2020 to 30$^{th}$ June 2021, the daily average of ADR is 1.20 for the Bombay Stock Exchange. It is also observed that out of 310 days during pandemic, for189 days the ADR was greater than 1 while for 121 days the ADR was less than equal to 1. That means capital market in India during the pandemic witnessed overbought conditions for a greater number of days than oversold conditions.

The present study is an attempt to understand how the stock market responds to the change in ADR during the Covid-19. Whether there exists any significant relationship between ADR and the S&P BSE Sensex. Secondly to know how much the impact is, during an over-buying condition and an over-selling condition. This will surely be helpful for the investors in making their investment plans in case a similar situation prevails in future.

## 2. Review of Literature

### *2.1. Covid-19 Pandemic and Stock Market Performance*

There are several studies concerning the impact of Covid-19 on stock markets in various countries of the world. Baker *et al.* (2020) observed that the U.S. stock market reacted so much more forcefully to Covid-19 than to previous pandemics in 1918-19, 1957-58 and 1968. He *et al.* (2020) also noticed that there is a spill-over effect of Covid -19 on stock markets in Asia, Europe, and America. As per the research work of Salman and Ali (2021), there was a short-term negative impact of Covid-19 on the stock market in countries in the Gulf Corporation Council (GCC). Some studies are done based on the relationship between the number of Covid cases and its influence on stock market return. It was observed that the stock market Index varies positively with the number of patients infected (Madai,

2021). Onali (2020) noticed that the US stock market exhibited volatility in the market during the Covid-19 pandemic. A study by Bora and Basistha (2021) observed that the stock market was volatile during Covid and declined during the initial days of the first lockdown but recovered well then. Buszko *et al.* (2021), in their research on the stability of the stock market in CEE countries observed that despite some sectoral hits, the market is found to be stable when analysed concerning profitability, volatility, and turnover. There are also studies that indicated the increase in retail participation in the stock market. Ozik *et al.* (2021), in their research work found that because of Stay-at-Home advisory from US Government, the stock market witnessed better liquidity due to retail participation during the pandemic. The significant determinants for retail participation were ample free time and access to the financial market provided by Fintech innovations to the trading platform. In India also retail participation in the stock market has seen a jump during the pandemic.

### *2.2. Advance-Decline Ratio and Stock Market Performance*

Advance-decline ratio (ADR) represents a ratio of the number of advancing shares and number of declining shares on a trading day. In other words, ADR is a measure of market breadth and provides a holistic movement of all the shares traded on a day. With respect to ADR, there are not many research studies available for the Covid-19 duration. However few studies in the past reflect some mixed results regarding the impact of ADR on the stock market. Joshi and Bhavsar (2011) & Patel (2015), in their research work observed that there is no significant relationship between the advance-decline ratio and Nifty 50 index. The study was conducted through different regression models with lagged ADR and Nifty returns and the conclusion derived was that it is not possible to predict the future market with the help of past ADR. But there are also studies that suggested that the advance-decline ratio as an indicator, hints at the bullish and bearish trend of the market. Zakon and Pennypacker (1968) observed that technical analysts for their short-term prediction use advance-decline line. Investor sentiment also is linked to ADR which causes excess volatility in the market and in the case of the inefficient market because of asymmetric information, it results in excess return for the investors and the portfolio managers (PH and Rishad, 2020). A study by Zaremb *et al.* (2021) noticed that market breadth along with herding behaviour takes the market upward or downward.

Though there are some literatures on the impact of Covid-19 as well as ADR on stock market return in several countries, very few research exist in India. The present study is unique in two aspects. Firstly, how advance-decline ratio (ADR) affects the market return for pre-and during pandemic and second, how the ADR impacts the market under overbought and oversold situations during the Covid-19 pandemic.

## 3. Objectives and Hypothesis of the Study

### *3.1. Objectives of the Study*

- To understand the impact of the advance-decline ratio on the stock market return before Covid-19 as well as during the pandemic.

- To study the impact of ADR on stock market return under overbought and oversold situations during the Covid-19 pandemic.

### 3.2. Hypothesis of the Study

$H_{01}$: There is no impact of ADR on SR during and prior to Covid-19 pandemic

## 4. Research Methodology

### 4.1. Data and Sample

The daily data of S&P BSE Sensex and day wise number of stocks advanced and declined was collected from the BSE website for the period from March 2011 till June 2021. The rationale behind the duration is that it will indicate 9 years trend of ADR and S&P BSE sensitive index for a pre-Covid period (March 2011 to March 2020) and about 14 months of daily data of the pandemic or Covid period (April 2020 to June 2021).

### 4.2. Research Variables

Two variables are used for the study with reference to different time references such as pandemic and a before pandemic. The dependent variable is the S&P BSE Sensex return (SR), and the independent variable is the advance-decline ratio (ADR).

### 4.3. Model Specification

The impact of ADR on stock market return is studied through a regression model with S&P BSE Sensex return (SR) as the dependent variable and ADR as the independent variable. The degree of dependence of ADR during the Covid and pre-Covid periods is compared after checking the stationarity aspect of the time series data of both SR and ADR using the Augmented Dickey-Fuller (ADF) test. For ease of understanding the S&P BSE Sensex return is symbolised as "SR" and advance-decline ratio is represented as "ADR". For the second part of the study, the ADR data was segregated into two scenarios, overbought scenario (ADR >1) and oversold scenario (ADR≤1). The regression model is used to understand the impact during the overbought and oversold situations.

$$SR_t = \ln (S_t/S_{t-1}) \text{ where } S_t = \text{Closing price of S\&P BSE Sensex on t Date.}$$

$$ADR = \frac{Number\ of\ stocks\ whose\ prices\ advanced\ compared\ to\ previous\ day\ closing\ price}{Number\ of\ stocks\ whose\ prices\ declined\ compared\ to\ previous\ day\ closing\ price}$$

## 5. Data Analysis

### 5.1. Unit Root Test

The Stationarity Test is administered for both the variables SR and ADR at level using E views software and it was observed that both the variables satisfied the stationarity condition as per ADF unit root test. (Table 1 & Table 2).

**Table 1: Augmented Dickey-Fuller Test Result for Stationarity during Covid Period**

| *At Level* | *Intercept* | | *Trend & Intercept* | | *None* | |
|---|---|---|---|---|---|---|
| | *t-Statistic* | *Prob.* | *t-Statistic* | *Prob.* | *t-Statistic* | *Prob.* |
| SR | -18.55683 | 0.0000 | -18.62817 | 0.0000 | -18.17702 | 0.0000 |
| ADR | -13.66783 | 0.0000 | -13.68135 | 0.0000 | -2.006502 | 0.0431 |

*Source:* Author's Compilation

**Table 2: Augmented Dickey-Fuller Test Result for Stationarity in Pre- Covid Period**

| *At Level* | *Intercept* | | *Trend & Intercept* | | *None* | |
|---|---|---|---|---|---|---|
| | *t-Statistic* | *Prob.* | *t-Statistic* | *Prob.* | *t-Statistic* | *Prob.* |
| SR | -46.29738 | 0.0001 | -46.29605 | 0.0000 | -46.28875 | 0.0001 |
| ADR | -26.49090 | 0.0000 | -26.52608 | 0.0000 | -2.245535 | 0.0239 |

*Source:* Author's Compilation

Table 1 and Table 2 confirm that the variables used for the study are satisfying the stationarity condition at 5% significance level. As the p-values are below 0.05, the null hypothesis cannot be accepted and hence the alternative hypothesis is accepted which states that the variables SR & ADR do not have unit root and hence, they are stationary at levels.

Since both the variables are satisfying stationarity condition at level so ordinary least square regression technique is used for both the periods, i.e., for pre-Covid and during Covid period, considering Sensex return "SR" as the dependent variable and the advance-decline ratio 'ADR' as the independent variable.

### *5.2. Advance-Decline Ratio and its impact on Market Return*

#### *5.2.1. During the Covid-19 Pandemic*

The main part of this research paper is to examine how the advance-decline ratio is impacting the market return before and during the pandemic. The following model is used to study the impact of change in ADR on SR using the OLS regression.

$$SR_t = C + b(ADR_t) + e_t$$

The null hypothesis: $H_{01}$ states that ADR has no significant impact on SR or in other words b=0.The result of the OLS regression is depicted in Table 3.

The model indicates that the Sensex return is dependent on the ADR with b= 0.014995 and R-Squared value 0.37432. The variability of SR is explained up to 37.4% by the variability of ADR.

**Table 3: Least Square Regression Result during the Covid-19 Pandemic**

| *Variable* | *Coefficient* | *t-Statistic* | *Prob.* |
|---|---|---|---|
| C | -0.016136 | -11.04577 | 0.0000 |
| ADR | 0.014995 | 13.57440 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.374320 | Mean dependent var | 0.001862 |
| Adjusted R-squared | 0.372289 | S.D. dependent var | 0.013628 |
| S.E. of regression | 0.010798 | Akaike info criterion | -6.212556 |
| Sum squared resid | 0.035909 | Schwarz criterion | -6.188449 |
| Log likelihood | 964.9461 | Hannan-Quinn criter. | -6.202919 |
| F-statistic | 184.2644 | Durbin-Watson stat | 1.936457 |
| Prob(F-statistic) | 0.000000 | | |

*Source:* Author's Compilation

The residual diagnosis is also done through the Breusch-Godfrey serial correlation LM test to understand the existence of serial correlation, and the null hypothesis of no serial correlation could not be rejected. (Table 4)

**Table 4: Breusch-Godfrey Serial Correlation LM Test**

| | | | |
|---|---|---|---|
| F-statistic | 0.133966 | Prob. F (2,306) | 0.8747 |
| Obs*R-squared | 0.271197 | Prob. Chi-Square (2) | 0.8732 |

*Source:* Author's compilation

Though the model may not be used as a predictive model for the movement of the capital market, but this always may be utilised for understanding the relationship of market breadth to the stability of the market performance. The market was performing better during most of the Corona crisis despite the economic slowdown.

### *5.2.2. During Pre-Covid period*

To understand further the impact of ADR in long run, the study initiated to estimate the equation for SR based on daily data for a longer duration of 9 years from March 2011 to March 2020, considered here as pre-Covid duration. The variables meet the stationarity condition, and the OLS regression result is depicted in Table 5 below.

By comparing Table 3 and Table 5, it is observed that the relationship between ADR and SR is almost similar before and during the pandemic. The R-squared value and regression coefficient of independent variable, as per the regression results are very similar for both pre-Covid and during Covid period.

**Table 5: OLS Regression Output for Pre-Covid Duration**

| *Variable* | *Coefficient* | *t-Statistic* | *Prob.* |
|---|---|---|---|
| C | -0.011861 | -29.89361 | 0.0000 |
| ADR | 0.011706 | 34.28784 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.345613 | Mean dependent var | 0.000218 |
| Adjusted R-squared | 0.345319 | S.D. dependent var | 0.010648 |
| S.E. of regression | 0.008616 | Akaike info criterion | -6.669546 |
| Sum squared resid | 0.165240 | Schwarz criterion | -6.664421 |
| Log likelihood | 7431.874 | Hannan-Quinn criter. | -6.667674 |
| F-statistic | 1175.656 | Durbin-Watson stat | 1.943270 |

*Source:* Author's Compilation

### *5.3. Impact of ADR on SR, in Overbought and Oversold Scenarios during the Pandemic*

The study further investigated the short run impact of ADR on SR in two scenarios. One scenario, when ADR >1 and another when ADR ≤ 1.

After checking for stationarity test for both the variables during the two phases an OLS regression model is employed with SR being the dependent variable and ADR as an independent variable. The result estimates that the impact of ADR is more sensitive when ADR ≤ 1 in comparison to that when ADR > 1.

**Table 6: Augmented Dickey-Fuller Test Result for Stationarity for ADR > 1 Scenario**

| *Variables at Level* | *Intercept* | | *Trend & Intercept* | | *None* | |
|---|---|---|---|---|---|---|
| | *t-Statistic* | *Prob.* | *t-Statistic* | *Prob.* | *t-Statistic* | *Prob.* |
| SR | -14.78870 | 0.0000 | -15.35238 | 0.0000 | -5.020090 | 0.0000 |
| ADR | -13.39555 | 0.0000 | -13.58285 | 0.0000 | -1.021111 | 0.2756 |

*Source:* Author's Compilation

**Table 7: Augmented Dickey-Fuller Test Result for Stationarity for ADR ≤ 1 Scenario**

| *Variables at Level* | *Intercept* | | *Trend & Intercept* | | *None* | |
|---|---|---|---|---|---|---|
| | *t-Statistic* | *Prob.* | *t-Statistic* | *Prob.* | *t-Statistic* | *Prob.* |
| SR | -10.40258 | 0.0000 | -10.36726 | 0.0000 | -8.788853 | 0.0000 |
| ADR | -10.04462 | 0.0000 | -10.00400 | 0.0000 | -0.243204 | 0.5966 |

*Source:* Author's Compilation

### 5.3.1. Case-I: Impact of ADR on SR for ADR ≤ 1 Scenario

The OLS regression with SR as the dependent variable and ADR as the independent variable is studied for the 121 days observations of the pandemic during which ADR ≤ 1, that means the number of stocks that have advanced is either less than or equal to the number of stocks that has declined for a day. The situation during which there is more selling than buying trend. The result is mentioned in Table 8.

**Table 8: OLS Regression Result for ADR ≤ 1 Scenario**

| *Variable* | *Coefficient* | *Std. Error* | *t-Statistic* | *Prob.* |
|---|---|---|---|---|
| C | -0.035748 | 0.003318 | -10.77555 | 0.0000 |
| ADR | 0.041948 | 0.004521 | 9.279007 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.419795 | Mean dependent var | -0.006005 |
| Adjusted R-squared | 0.414919 | S.D. dependent var | 0.012299 |
| S.E. of regression | 0.009407 | Akaike info criterion | -6.478228 |
| Sum squared resid | 0.010532 | Schwarz criterion | -6.432017 |
| Log likelihood | 393.9328 | Hannan-Quinn criter. | -6.459460 |
| F-statistic | 86.09998 | Durbin-Watson stat | 1.875832 |

*Source:* Author's Compilation

### 5.3.2. Case-II: Impact of ADR on SR for ADR >1 Scenario

During the study period of 310 days between April 2020 to June 2021, which is categorised here as pandemic, for 189 days ADR was greater than 1. That means there was more buying than selling. The empirical investigation with SR as the dependent variable and ADR as the independent variable is mentioned in Table 9.

**Table 9: OLS Regression Result for ADR >1 Scenario**

| *Variable* | *Coefficient* | *Std. Error* | *t-Statistic* | *Prob.* |
|---|---|---|---|---|
| C | -0.010025 | 0.002591 | -3.869634 | 0.0002 |
| ADR | 0.011173 | 0.001631 | 6.851119 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.200642 | Mean dependent var | 0.006898 |
| Adjusted R-squared | 0.196368 | S.D. dependent var | 0.011975 |
| S.E. of regression | 0.010735 | Akaike info criterion | -6.220150 |
| Sum squared resid | 0.021549 | Schwarz criterion | -6.185846 |
| Log likelihood | 589.8042 | Hannan-Quinn criter. | -6.206252 |
| F-statistic | 46.93783 | Durbin-Watson stat | 1.848678 |
| Prob(F-statistic) | 0.000000 | | |

*Source:* Author's Compilation

## 6. Results and Discussion

The basic observation from the output of the regression model is that ADR significantly affects SR. The regression coefficient of the independent variable ADR during and before Covid-19 is observed to be 0.0149 and .0117 respectively. Thus, indicating that the ADR affects slightly in a greater way to the market return during the pandemic than that of a normal period before the pandemic. Hence, ADR may be used as an indicator for the investors looking forward to investing in the stock market. However, R-squared values as mentioned in Table 3 and Table 5 are observed to be 34% to 37% respectively, which indicate that there are still other factors that have influenced the stock market other than ADR.

With reference to Table 8 and Table 9 during the oversold situation i.e., when ADR ≤ 1, the market return varies by 0.041 units for every 1 unit change in ADR and the variability in SR is explained up to 41.97% by the variability in ADR. But, during overbought situation i.e., when ADR >1, the market return varies by only 0.011 units for a change of 1 unit by the ADR. So as an outcome of this study it is observed that the stock market is more sensitive to the oversold scenario during the pandemic in comparison to the overbought scenario. Covid duration for this study has a total of 310 days out of which 189 days the market witnessed over-buying condition and 121 days of over-selling condition. So, in other words, the Covid duration is more inclined to a buying behaviour than a selling behaviour. This may be one of the reasons that the market has shown a growth of about 85% during these 310 days while on a study period of about 9 years market has grown only 59%.

Another important observation during the Covid period is that the average trade size is less than that of the normal period. One inference may be drawn from this observation that the investors are putting lesser money than the normal period and hence playing safe by taking the calculative risk. The second inference may be that during Covid-19, it is observed that there is a growth in the percentage of retail participation. This may be the reason that the average trade size per day is lower during the Covid-19 period than that of the normal period. Retail participation is always a good sign for any market. Because of lockdown and work from home option, female participation in stock trading also has gone up. Another interesting observation is the shift in mode of trading. Trading with the mobile phone has grown significantly in comparison to other modes. These changes in stock market acted as a positive sign for the growth and stability of the capital market during the pandemic.

## 7. Conclusion

The capital market in India during the pandemic has not suffered from the surprise shocks, rather attained the highest value ever. Despite high inflation, low GDP growth, the S&P BSE Sensex has shown a rising trend. The best part of this trend is that it is backed by a good market breadth as measured by the advance-decline ratio. During the pandemic the average daily ADR was 1.20. That means the number of stocks advanced is 1.2 times that of the number of stocks declined.

The advance-decline ratio as an important indicator significantly affects the performance of the stock market during the pandemic. The regression coefficient during the pandemic is 0.014995 while the same is 0.011706 for the pre-Covid period. It was also observed that the market return is more sensitive to the oversold situation than that of the overbought situation as the regression coefficient is

0.041948 in the former case while it is only 0.011173 in the latter case. Though there are so many other factors that affect the stock market, but advance-decline ratio (ADR) also may be considered as an important indicator while studying the performance of the stock market in India.

The present study also implies that the stock market performance in India was reasonably stable, except few occasions of the first lockdown during the last week of March 2020. Out of 310 days of data during the Covid period under study, the ADR is greater than 1 for 189 days. That means for most of the days during the pandemic the number of stocks advanced is higher than the number of stocks that declined. This is also the reason that the S&P BSE Sensex has increased by about 85.5 % during the first and second wave of the Covid-19, while it has increased only 59.75% during the 9 years of pre-Covid duration under study.

The outcome of this study has relevance to retail investors who may refer to the advance-decline ratio before investing their hard-earned money in the capital market. Daily Average ADR > 1 may be considered a good market and investors may expect some stability and there may be a lesser chance of any unpredictable risk. Advance-decline ratio represents the market breadth, and it indicates a wholistic movement of all stocks traded in the stock market on a day. Thus, the stock traders get an idea about the market condition before making any decision whether to buy or sell. Regulators also may monitor the ADR to understand if the rise or fall in the stock market is backed by the movement of ADR or not. In other words, regulators get a signal whether the market movement is because of a few stocks, or the majority of stocks as represented by the advance-decline ratio. This empirical study may be further extended by other researchers in the field of behavioural finance to know the psychological mindset of investors that drives ADR in a normal and a pandemic situation.

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