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AN ANALYSIS OF RISK OF SECTORAL INDEXES IN BSE DURING OUTBREAK OF COVID-19

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Abstract

Stock market is considered to be one of the indicators of the economy of a country. Indian stock market witnessed a massive set back amid COVID-19 like other developed stock markets of the world. In our study, we have analysed the sensitivity of different sectoral indexes with respect to overall market index. The study is completely based on Indian stock market. For the purpose of the study, we have chosen certain sectors like IT, Realty, Health, Energy, Oil and Gas, FMCG, Telecom and Private Banks. The market specific and sector specific risk have been analysed as per Markowitz Model and Sharpe Index Model. The concept of Beta, as developed by Treynor, Sharpe and Linter in their world-famous Capital Asset Pricing Model (CAPM), has been used. In this study, the main focus has been laid on the change in the risk of different indexes during COVID-19. From the comparison of Beta values between pre and during COVID-19 period, it was found that most of the sectors became less responsive towards the change in the market excepting IT and Private Bank. By comparing the total risk using Markowitz and Sharpe Index Model, it has been found that during COVID-19, risk of all the sectors have significantly increased. An analysis of the classification of market specific and sector specific risk using Markowitz and Sharpe Index Model has been done and it has been found that there is an increase in systematic risk for all the sectors during COVID-19 but IT and Realty sector's unsystematic risk have decreased during COVID-19.

Keywords: *COVID-19, Sectoral Index, Systematic risk, Unsystematic Risk*

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Introduction

Spread of COVID-19 had a devastating impact on the world economy. The entire world had gone through a great financial crisis because economic activities were under lockdown. This evolved as a threat to most of the sectors but there were certain sectors for which it has emerged as an opportunity. For example, it can be cited that the private and public companies, educational institutions were going online for conduction of their activities; they were using different platforms for conducting meetings, online classes etc. Video conferencing applications like Zoom, Google Meet, Cisco Webex, Team Link etc. emerged as new market players. Zoom Video Conferencing INC., listed in NASDAQ, reported share price of 76.30 USD in the month of January, 2020 but in June, 2020 the reported average price of the same share was 219.52 USD. Thus, there was an annualised increase of 450.59% even during the economic crisis due to pandemic. The reason is quite understandable that ample use of this video conferencing app was showing a future prospect of profitability of this company and investors were showing interest in investing their funds in the company whereas, the overall market index was showing a declining trend. So, it can be said that responsiveness of return of Zoom video conferencing INC with respect to NASDAQ's Index's return was negative.

Stock market is considered to be one of the important indicators of the economy of a country. Indian stock market witnessed a massive set back due to COVID-19 like the other stock markets across world. In our study, we will be analysing the sensitivity of different sectoral indexes with respect to overall market index. Our study is completely based on Indian stock market and we have chosen certain sectors like IT, Realty, Health-Care, Energy, Oil and Gas, FMCG, Telecom and Private Banks. The study is aimed towards analysing the market specific and sector specific risk. For the purpose of analysing the risk Markowitz Model and Sharpe Index Model has been used and for the purpose of measuring the sensitivity, the concept of Beta, as developed by Treynor, Sharpe and Linter in their world-famous Capital Asset Pricing Model (CAPM), has been used.

Literature Review

The market performance of 19 sectoral indices of the Bombay Stock Exchange (BSE) based on their market turnover value were examined from 2012 to 2022. Descriptive Statistics, Correlation Analysis, Multiple Regression Analysis, t-test, ANOVA (Analysis of Variance) have been used to analyse the data. It was found that BSE Consumer Durables performed well in-terms of returns, followed by BSE Information Technology, BSE Teck, BSE Bankex, BSE Energy, BSE Finance. The study also provides evidence that BSE Consumer Durables has high volatility as compared to rest of the indices. (Jahnavi et al. 2023)

Weekly data on COVID-19 fatality cases, an independent variable, in India from 1 March 2020 to 27 December 2020 has been taken from the official website of the World Health Organization and weekly data on a dependent variable (Sensex) and control variables (crude

oil, Bitcoin, Ethereum, Litecoin) have also been considered for the period under study to investigate the impact of COVID-19 on the volatility of BSE Sensex stock index. GARCH (1,1) model, vector error correction model (VECM) and various tests like ADF, variance decomposition test, impulse response test have been used in the study. Significant negative effect of COVID-19 fatality cases on BSE Sensex stock index was found during the specified study period. (Bhullar, Gupta and Bhatnagar 2022).

Effects of COVID-19 outbreak on daily stock returns for the six major affected WHO Regions, namely: Africa, Americas, Eastern Mediterranean, Europe, South-East Asia and Western Pacific have been analysed. Event study method and panel-data regression models have been used to examine the effect of the daily increase in the number of COVID-19 confirmed cases on daily stock returns from 1st March to 1st August 2020 for the leading stock market in major affected countries in the WHO regions. Adverse impact of the daily increasing number of COVID-19 cases on stock returns and stock markets have been found. It has also (Al-Qudah and Houcine 2022). An investigation into the impact of COVID-19 on the volatility of stock prices in India with the help of a generalized autoregressive conditional heteroscedasticity model revealed higher return on the indices in the pre-COVID-19 period than during COVID-19. For the purpose of the study, daily closing prices of stock indices, Nifty and Sensex from September 3, 2019 to July 10, 2020 was used. (Bora and Basistha 2021)

EGARCH, FIGARCH, FIEGARCH and TGARCH models have been used to analyse the volatility dynamics of the Tunisian sectorial stock market indices during the COVID-19 outbreak period. More volatility in all the series was found during COVID-19 outbreak. It was also found that there is an insignificant asymmetric effect in the return volatilities of construction and food and beverage sector while return volatilities of consumer service, financials and distribution, industrials, basic materials and banks sector have relatively high positive and significant asymmetric effect compared to those during the pre-COVID-19 period (Fakhfekh, Jeribi and Salem 2021).

No previous infectious disease outbreak, including the Spanish Flu, has impacted the stock market as forcefully as the COVID-19 pandemic. It has been suggested by evidences that government restrictions on commercial activity and social distancing, operating with powerful effects in a service-oriented economy, are the main reasons the U.S. stock market reacted more forcefully to COVID-19 than to previous pandemics in 1918-19, 1957-58 and 1968. (Baker, et al., 2020). It is hard to predict the magnitude and impact of Coronavirus on the economy, but it is certain that the markets will bounce back soon the crisis gets over. With an average annual return (CAGR) of around 15 per cent, by growing from 100 points in 1979 to over 41,000 points in 2019, Sensex has proven time and again that corrections are temporary, but growth is permanent (Ravi, 2020). The short-term impact of the coronavirus outbreak on 21 leading stock market indices in major affected countries including Japan, Korea, Singapore,

the USA, Germany, Italy, and the UK etc. have been evaluated and it has been observed that countries in Asia experienced more negative abnormal returns as compared to other countries. (Liu, Manzoor, Wang, Zhang, & Manzoor, 2020).

It has been found that global financial market risks have increased substantially in response to the pandemic. Individual stock market reactions are clearly linked to the severity of the outbreak in each country. The great uncertainty of the pandemic and its associated economic losses has caused markets to become highly volatile and unpredictable. (Zhang, Hu, & Ji, 2020).

Research Gap

On the basis of the existing literatures it has been found that most of the previous researchers tried to explore the impact of pandemic on stock market of different countries like USA, China etc. Some literatures have also highlighted the major reasons which have affected the particular sector in our country during COVID-19. But no literature has been found to analyse the change in the risk pattern of different sectoral indexes during COVID-19 in Indian stock market.

Objectives

The objectives of the present study are:

1. To analyse the change in sensitivity of different sectoral indexes towards change in market index (sensitivity measured in terms of Beta) during COVID-19.
2. To analyse the change in systematic (market specific) and unsystematic (sector specific) risk of different sectoral indexes as per Sharpe and Markowitz Model during period of COVID-19.

Research Methodology

In this present study we have applied simple linear regression model to determine the sensitivity or beta of the sectoral indexes. It has been decided to work on the following sectors and their respective indexes are shown in Table 1.

The following regression equation has been used to determine the Beta (β) of the sectoral indexes-

$$\text{BSE Sectoral Index}_i = \alpha + \beta . \text{BSE Sensex}_i + \varepsilon_i$$

Where, BSE Sectoral Index_i stands for the indexes of respective sectors used in the regression model;

BSE Sensex_i is used as a proxy of overall market movement;

α Stands for the intercept;

β stands for coefficient of BSE SENSEX; and

Table 1 : Sector and its corresponding Indexes

Name of the Sector	Name of the Index
Telecom	S&P BSE Telecom Index
Realty	S&P BSE Realty Index
Oil & Gas	S&P BSE Oil & Gas Index
Health Care	S&P BSE Healthcare Index
Private Banks	S&P BSE Private Banks Index
FMCG	S&P BSE Fast Moving Consumer Goods Index
IT	S&P BSE Information Technology Index
Energy	S&P BSE Energy Index

Source: BSE website

ε_i is the random error of the regression model.

Time series data of daily returns of different sectoral indexes and BSE Sensex from 01.03.2015 to 29.02.2020 (5 years' daily time series data) have been used to measure the sensitivity of the different sectoral indexes in Pre-COVID-19 period. We have also used the time series data set from the period 1st March, 2020 to 18th June, 2020 for capturing the sensitivity of the sectoral indexes during first wave of COVID-19. Although it is a very small time series data but an attempt has been made to capture the sensitivity of the sectoral indexes during the time period when the economic activities are partially or fully under lockdown. In this present study we will do the analysis of systematic and unsystematic risk of the sectoral indexes by applying Markowitz Model and Sharpe Index Model.

For the purpose of calculating Beta, required for determining the sensitivity/systematic risk, we have calculated return of the different sectoral indexes as well as BSE Sensex return. Return has been calculated with the help of the following formula:

$$\frac{I_{t+1} - I_t}{I_t} \times 100$$

Where, I_{t+1} refers to t+1 day's index and I_t refers to today's index

For analysing the total risk, traditional formula of risk as per the theory of portfolio management has been used which is shown below:

Total risk = Systematic Risk (Market Risk) + Unsystematic Risk (Sector-Specific/Company-Specific)

Markowitz Model		Sharpe Index Model	
Systematic Risk	Unsystematic Risk	Systematic Risk	Unsystematic Risk
σ_m x β	$\sigma_I - (\sigma_m$ x $\beta)$	σ_m x β	ε

σ_I = Standard Deviation of Index

σ_m = Standard Deviation of Market

β = Beta

Systematic Risk = $(\sigma_m \times \beta)$

Unsystematic Risk = $\sigma_I - (\sigma_m \times \beta)$

ε= Error term

Results and Discussions

Table 2 : Regression Equation (BSE Sectoral Index$_i$= α+β. BSE Sensex$_i$+?$_i$)

Sectoral Index	Pre-Covid 19	During Covid 19
S&P BSE Telecom Index	-0.02328+0.8195* BSE Sensex	0.2822+ 0.7856* BSE Sensex
S&P BSE Realty Index	0.0047+1.1208* BSE Sensex	-0.3066+0.8612* BSE Sensex
S&P BSE Oil & Gas Index	0.0079+0.9339* BSE Sensex	0.1601+0.8607* BSE Sensex
S&P BSE Healthcare Index	-0.0091+0.6776* BSE Sensex	0.3431+0.5230* BSE Sensex
S&P BSE Private Banks Index	-0.0029+1.1864* BSE Sensex	-0.1966+1.2316* BSE Sensex
S&P BSE Fast Moving Consumer Goods Index	0.0166+0.7065* BSE Sensex	0.0732+0.6397* BSE Sensex
S&P BSE Information Technology Index	0.0157+0.6927* BSE Sensex	0.0746+0.8070* BSE Sensex
S&P BSE Energy Index	0.0409+1.0219* BSE Sensex	0.3890+1.005* BSE Sensex

*significant at 1% level

Source: Compiled by authors

Table 2 shows that all the sectoral indexes have been regressed by the market index (BSE Sensex) by using time series data of 5 years immediately preceding COVID-19 period starting from 01.03.2015 to 29.02.2020 and the time series data from 01.03.2020 to 18.06.2020 has been used. It is to note that all the co-efficient values of independent variable (i.e. BSE Sensex) are highly significant at 1% level as the P value is 0.00.

Table 3 shows the Beta value of different sectoral indexes for pre and during COVID-19 period. As per CAPM developed by Treynor, Sharpe and Linter, Beta indicates the systematic risk associated with investment in a particular stock/ sector with respect to the market risk. It means it shows the degree of responsiveness of a particular company/ sector with respect to market return.

Table 3 : Comparison of Beta values (β) pre and during Covid 19 period

Sectoral Index	Beta Pre-Covid 19 Period	Beta During Covid -19 Period	% Change in Beta
S&P BSE Telecom Index	0.82	0.79	-4.13
S&P BSE Realty Index	1.12	0.86	-23.16
S&P BSE Oil & Gas Index	0.93	0.86	-7.84
S&P BSE Healthcare Index	0.67	0.52	-22.80
S&P BSE Private Banks Index	1.18	1.23	3.81
S&P BSE Fast Moving Consumer Goods Index	0.70	0.64	-9.46
S&P BSE Information Technology Index	0.69	0.81	16.50
S&P BSE Energy Index	1.02	1.01	-1.57

Source: Compiled by authors

Beta value of more than 1 indicates higher level of risk and Beta value less than 1 indicates lower level of risk. In the present study, we have chosen eight sectors and the above table shows that in Pre-COVID-19 period only Realty sector, Private Banks and Energy sectors' indexes were having Beta value more than 1. It means that these sectors were more responsive towards the market change during Pre-COVID-19 period.

We have also calculated Beta value of the sectoral indexes during COVID-19 period and we have found that only private Banks and Energy sectors' Beta value continued to remain more than 1. Whereas realty sectors' Beta value became less than 1 which means that Realty sector's index became less responsive towards market change in the COVID-19 period. Another important point is to note that excepting S&P BSE Private Bank Index and S&P BSE IT Index, all other sectors' indexes have declined. A considerable decline in terms of percentage has been witnessed in Realty and Heath Care sector. Realty sector's Beta has decreased by 23.16% and Heath Care sector's Beta has decreased by 22.80%.

Table 4 shows the total risk of the different sectoral indexes measured by Markowitz Model and Sharpe Index Model. We know that as per Markowitz Model, Standard deviation is used to measure total risk of a particular company or a particular index. It is seen that total

Table 4 : Total Risk of Sectoral Indexes by Markowitz and Sharpe Index Model

Sectoral Index	Markowitz Model			Sharpe Index Model		
	Risk (Pre-Covid)	Risk (During Covid)	% Change in Risk	Risk (Pre-Covid)	Risk (During Covid)	% Change in Risk
S&P BSE Telecom Index	1.75	3.80	116.33	2.70	5.38	99.46
S&P BSE Realty Index	1.90	3.38	77.90	3.19	4.61	44.32
S&P BSE Oil & Gas Index	1.45	3.35	130.61	2.53	4.55	79.82
S&P BSE Healthcare Index	1.19	2.49	108.97	1.97	3.53	79.04
S&P BSE Private Banks Index	1.51	4.52	198.10	2.88	5.83	102.34
S&P BSE Fast Moving Consumer Goods Index	1.11	2.77	149.31	1.92	3.89	102.16
S&P BSE Information Technology Index	1.30	3.20	144.43	2.10	4.37	107.24
S&P BSE Energy Index	1.53	3.94	156.85	2.71	5.37	97.85

Source: Compiled by authors

risk of all the indexes have increased during COVID-19 period. It is noteworthy to mention that as per Markowitz Model S&P BSE Private Bank Index has reported the highest increase in the risk and it has increased by 198.10% followed by Energy and FMCG sector. Another significant point to note is that, Realty sector has reported only 77.90% increase which is the lowest as compared to other sector considered in the study. As per Sharpe Index Model, highest increase in total risk is reported by S&P BSE IT Index which has increased by 107.74% during COVID-19 period and it is followed by Private Bank and FMCG Index. One similarity is found under both the models that Realty sector has reported the lowest percentage change in risk.

Table 5 shows the classification of systematic and unsystematic risk i.e. the market specific and sector specific risk as per Markowitz Model. We know that as per Markowitz Model, unsystematic risk is a residual risk i.e. the difference between total risk and systematic risk. It

Table 5 : Classification of Systematic and Unsystematic Risk as per Markowitz Model

Sectoral Index	Pre-Covid-19 Period		During Covid-19		% Change in Systematic Risk	% Change in Unsystematic Risk
	Systematic Risk	Unsystematic Risk	Systematic Risk	Unsystematic Risk		
S&P BSE Telecom Index	0.94	0.80	2.69	1.10	184.88	36.08
S&P BSE Realty Index	1.29	0.60	2.95	0.42	128.34	-29.69
S&P BSE Oil & Gas Index	1.07	0.37	2.95	0.40	173.86	6.56
S&P BSE Healthcare Index	0.78	0.40	1.79	0.69	129.39	69.99
S&P BSE Private Banks Index	1.36	0.14	4.22	0.29	208.49	100.75
S&P BSE Fast Moving Consumer Goods Index	0.81	0.29	2.19	0.57	169.05	94.63
S&P BSE Information Technology Index	0.79	0.50	2.76	0.42	246.18	-15.72
S&P BSE Energy Index	1.17	0.35	3.45	0.49	192.50	38.42

Source: Compiled by authors

is found in Table 5 that the market specific risk for all the sectors have increased and IT sector has reported the highest increase in systematic risk. It has increased by 246.18% followed by Private Bank and Energy sector. It is important to note that the sector specific/ unsystematic risk of IT sector and Realty sector has decreased during COVID-19 period whereas for all other sectors, the unsystematic risk or sector specific risk has increased. Highest increase in unsystematic risk has been reported by S&P BSE Private Bank Index.

Table 6 : Classification of Systematic and Unsystematic Risk as per Sharpe Index Model

Sectoral index	Pre-Covid Period		During Covid		% change in systematic risk	% change in unsystematic risk
	Systematic risk	Unsystematic risk	Systematic risk	Unsystematic risk		
S&P BSE Telecom Index	0.94	1.478	2.69	2.69	184.88	82.08
S&P BSE Realty Index	1.29	1.39	2.95	1.65	128.34	18.89
S&P BSE Oil & Gas Index	1.07	0.97	2.95	1.60	173.86	64.01
S&P BSE Healthcare Index	0.78	0.93	1.79	1.74	129.39	85.53
S&P BSE Private Banks Index	1.36	0.64	4.22	1.61	208.49	148.33
S&P BSE Fast Moving Consumer Goods Index	0.81	0.75	2.19	1.692	169.05	126.56
S&P BSE Information Technology Index	0.79	1.03	2.76	1.60	246.18	55.46
S&P BSE Energy Index	1.17	0.98	3.45	1.920	192.50	95.48

Source: Compiled by authors

Table 6 shows the classification of market specific (systematic) and sector specific (unsystematic) risk as per Sharpe Index Model. As per William Sharpe, unsystematic or sector specific risk is not a residual risk rather in regression equation the Standard Error that we get, is basically the unsystematic/ sector specific risk. Here, we have regressed the different sectoral indexes' return by using the BSE Sensex return thus we found the Standard Error for

all the regression equations. As per William Sharpe, Standard Error is the measure of unsystematic risk. But the concept of systematic risk is same as Markowitz Model. The table shows that during COVID-19 period, highest percentage change in sector specific risk has been reported by S&P BSE Private Bank Index and lowest increase is reported by S&P BSE Realty Index.

Observation Summary with Recommendations

Beta value of Security Market Line (SML) ascertained on regressing sectoral indices by market index revealed (shown in table 2 & 3) shows sensitivity of all the sectors towards change in market return decreased excepting private banks and IT sector. Therefore, securities belonging to these two sectors were more responsive to market change during the first wave of COVID-19. It is therefore, recommended that in future, if any economic crisis is observed, then investors need to be careful in planning their investment made in these two sectors.

Total risk measured by Markowitz and Sharpe single index model showed that BSE private bank index reported highest increase in total risk out of eight sectoral indices selected for the study. It was because the investors had a perception that the economic crisis might lead to default risk in loan provided by private sector banks. Risk was bifurcated in Systematic and Unsystematic Risk using Sharpe and Markowitz model. Both the models revealed that during the 1st wave of COVID 19, % change in unsystematic risk was highest in BSE Private bank index out of eight select sectoral indices**.** It is recommended that during crisis period through proper portfolio diversification this risk can eliminated.

Conclusion

In this present study, we have tried to focus on the change in the risk of different indexes during the pandemic COVID-19. From the comparison of Beta values between pre and during COVID-19 period, it has been found that most of the sectors have become less responsive towards the change in the market excepting IT and Private Bank. Total risk has also been compared using Markowitz and Sharpe Index Model and it has been found that during COVID-19, risk of all the sectors have significantly increased. Classification of market specific and sector specific risk have also been analysed by Markowitz and Sharpe Index Model and it has been found that there is an increase in systematic risk for all the sectors during COVID-19 but IT and Realty sector's unsystematic risk have decreased during COVID-19.

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