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PORTFOLIO BEFORE & AFTER COVID

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Abstract: Portfolio is a calculated combination of any and all types of securities like stocks, bonds and money market instruments. In this fluctuating market, diversification of investments helps to spread risk over many assets. The process of creating the right basket of broad asset classes and obtaining an optimum return with minimum risk is called Portfolio Construction. A thorough analysis of Risk Vs Return of each security both individually and as a part of the combination has to be conducted for the construction of a portfolio. There exist the classic Sharpe Model which has simplified Portfolio Management process by relating the return in a security to a Single Market Index. An optimal portfolio construction of listed stocks in NSE using CAPM & Sharpe's Single Index Model Portfolio Performance is evaluated using Sharpe Performance Index which considers both return and risk. The Study has focussed on the choice of securities Before and After COVID -19. The question studied is **"**Did COVID Impact Portfolio Building?" Answer is "Yes it did".

Keywords *- Beta coefficient, Risk and Return, Single Market Index, CAPM, Sharpe Model, Impact of COVID on market portfolio construction.*

Introduction

The COVID-19 pandemic is not just a global health emergency but a global economic downturn too. Quarantine, Lockdown, Curfew and Work from home have become the new norm world over. A complete shutdown of all economic activities which are NOT even remotely categorised as Essential/Vital/Indispensable/Crucial/Important/Necessary was an immediate need of the hour. All funds would be diverted towards only the "Essential/Vital/Indispensable/Crucial/Important/Necessary". A new type of consumption pattern arose over night and created market abnormality. Now this scenario needs a world class financial muscle to take the beating. No country, no economy and no financial market was spared.

The global financial market risk has plummeted to a new low never seen in the past. (Zhang et al., 2020). Investors were and are still gripped by the fear of uncertainty. The global stock market has struck out/wiped out about US$6 trillion in one week from 24th to 28th February (Ozili and Arun, 2020). Azimili (2020), rightly says increased uncertainty affects the required rate of return and consequently current market value of stocks. The market value of Standard & Poor (S&P) 500 indexes lowered by 30%.

There are two major stock indices in India- Bombay Stock Exchange (BSE), Sensex, and National Stock Exchange (NSE), Nifty. If we look at the Bombay Stock Exchange there is a drop in the Sensex index to 13.2% on 23rd March 2020. It was the highest single day fall after the news of the Harshad Mehta Scam, 28th April 1991 (Mandal, 2020).

Similarly, Nifty has also declined to almost 29% during this period. Some economists have considered the impact of COVID-19 on the Indian stock market as a 'Black-Swan Event' i.e. the occurrence of a highly unanticipated event with an extremely bad impact.

NIFTY 50 is a diversified 50 stock index accounting for 13 sectors of the economy. It is used for a variety of purposes such as benchmarking fund portfolios, index-based derivatives and index funds. NIFTY 50 is owned and managed by NSE Indices Limited (formerly known as India Index Services & Products Limited) (NSE Indices). NSE Indices is India's specialised company focused upon the index as a core product. The index represents 50 companies selected from the universe of NIFTY 100 based on free-float market capitalisation and liquid companies having average impact cost of 0.50% or less for 90% of the observations for a basket size of Rs. 10 Crores. The constituents should have derivative contracts available on NSE.
The financial market of India has equally witnessed sharp volatility as a result of the disruption of the global mark. This paper has tried building out two sets of portfolios one before and another post COVID set in to understand how the mix changed.

Review of Literature

Manamani Sahoo (2020) has used Descriptive statistics, regression analysis to study the impact of COVID-19 on stock market. The findings of This paper has empirically investigated the existence of day-of-the-week effect by using closing daily data for Nifty 50, Nifty 50 Midcap, Nifty 100, Nifty100 midcap, Nifty200, Nifty 100 Smallcap. The study period starts from 1 April 2005 to14 May 2020. The ARCH-LM and Durbin-Watson (DW) test statistics of the COVID-19 model reflect there is presence of heteroscedasticity as well as serious autocorrelation problems in the model.

Imroz Mahmud in 2019 has used Sharpe Index Model to construct an Optimal Portfolio applying Sharpe's Single-Index Model on Dhaka Stock Exchange. The constructed portfolio out performed every individual stock as well as the market index in terms of offering the optimal risk-return combinations. Nagendra Marisetty has used Sharpe Index Model and tried to construct an Optimal Portfolio. He found that it is good for those investors who think stock volatility is equal to market volatility. Dr. R. Nalini has used Sharpe's Single Index Model to "Optimal Portfolio Construction Using Sharpe's Single Index Model - A Study of Selected Stocks From BSE". Chintan A. Shah (June 2015) has used Sharpe Model, and Capital Asset Pricing Model (CAPM) to try and construct an Optimal Portfolio Using Sharpe Index Model & CAPM from the BSE Top 15 Securities. He finds the Sharpe model gives exact number of securities along with weightage for investment, while this was not possible while using the CAPM.

This study has focussed on the best fit choice of securities separately for both the portfolios Before COVID-19 and After COVID -19. In line with the global trend this study has also used the Capital Asset Pricing Model to pick every single asset and then built two separate portfolios Using the Sharpe Index Model for each period of Before COVID-19 and After COVID -19. Finally, the Sharpe Performance Index it has identified the better portfolio of the two – Before and After COVID-19.

Research Methodology

Descriptive research is neither complete quantitative nor fully qualitative research methodology, instead it interplays with the elements of both in the same study. This paper chooses Descriptive Research Methodology as it would most suit this study.

The objective of this paper was to try and answer the question **"**Did COVID -19 Impact Portfolio Building?". This has to be broken into three separate activities.

1. To Identify two separate list of Assets to be chosen for portfolio construction using the Capital Asset Pricing Model (CAP Model)
2. To Construct two Optimal Portfolio using Sharpe's Single Index Model (SI Model)
3. To Compare the performances of the two constructed portfolios using Sharpe Performance Index.

Secondary Data Sourcing

The overall strategy was to analyse the impact of Covid-19 pandemic on the Indian Stock market. The official website of National Stock Exchange (NSE) is the secondary data source. With the use of Capital Asset Pricing Model (CAPM) the stock buy/sell decision arrived at. The period of this study is about 2 years, which can be divided into pre-covid-19 pandemic and post-covid-19 pandemic. NSE index list of 50 companies across all the sectors have been chosen for the impact study pre and post Covid-19.

Research Framework

In this fluctuating market, diversification of investments helps to spread risk over many assets. Portfolio is a calculated combination of any and all types of securities like stocks, bonds and money market instruments. The process of creating the right basket of broad asset classes and obtaining an optimum return with minimum risk is called Portfolio Construction. A thorough analysis of Risk Vs Return of each security in silo and as a part of the combination has to be conducted for the construction of a portfolio.

Modern Portfolio Theory suggests that starting with the risk-free rate, the expected return of a portfolio increases as the risk increases. Any portfolio that fits on the Capital Market Line (CML) is better than any possible portfolio to the right of that line, because it isn't possible to perfectly build a portfolio that fits on the CML, it is more common for investors to take on too much risk as they seek additional return. This portfolio construct model for a basic pre and post study also helps to know the COVID impact on market volatility.

This study has used the Capital Asset Pricing Model to pick every single asset. It has built two separate portfolios Using the Sharpe Index Model for each period of Before COVID-19 and After COVID -19. Finally, the Sharpe Performance Index has identified the better portfolio of the two –Pre and Post COVID

Capital Asset Pricing Model (CAPM)

The Capital Asset Pricing Model (CAPM) describes the relationship between systematic risk and expected return for assets. Investors expect to be compensated for both risk and the time value of money. CAPM is widely used throughout finance for pricing risky securities and generating expected returns for assets given the risk of those assets and the cost of capital. If an investor were able to use the CAPM to perfectly optimize a portfolio's return relative to risk, it would exist on a curve called the efficient frontier.

The risk-free rate in the CAPM formula accounts for the time value of money. The goal of the CAPM formula is to evaluate whether a stock is fairly valued when its risk and the time value of money are compared to its expected return.

$$ER_i = R_f + \beta_i (E\ R_m - R_f)$$

ER_i - expected return of investment
R_f - risk-free rate
βi - beta of the investment
$(ER_m - R_f)$ - market risk premium

The beta of a potential investment is a measure of how much risk the investment will add to a portfolio that looks like the market. If a stock is riskier than the market, it will have a beta greater than one ($\beta_i > 1$). If a stock has a beta of less than one ($\beta_i < 1$), the formula assumes it will reduce the risk of a portfolio. A stock's beta is then multiplied by the market risk premium, which is the return expected from the market above the risk-free rate. The risk-free rate is then added to the product of the stock's beta and the market risk premium. The result should give an investor the required return or discount rate they can use to find the value of an asset.

What is this Sharpe's Single Index Model (SIM)?

The Single-Index Model (SIM) is a simple asset pricing model to measure both the risk and the return of a stock. This was developed by William Sharpe in 1963. With the help of Single Index Model, portfolio managers and security analysts can easily identify any one chosen security's excess return to beta ratio as a 'Single Value'. This model generates cut off rate based on data inputs and selects only those securities which have higher excess return to beta ratio as compare to cut-off rate. Then based on residual variance (unsystematic risk) of the security, excess return to beta ratio, beta of the security and cut-off rate, proportion or weightage of the investment of the selected security is computed.

$$R_i = \alpha_i + \beta_i R_f + \varepsilon_i$$

R_i - Expected Return on security i
R_f - Risk free rate
β_i - Beta of the security i
α_i - the abnormal returns for the stock i
ε - unsystematic risk of the security due to firm-specific factors.

Securities are ranked based on excess return to beta ratio from highest to lowest, this ranking represent the desirability for inclusion of that security into the portfolio. So, if security with particular ranking is included in portfolio, all the securities with ranking above will be included as well.

Cut-off Point

The cut-off point is the point at which an investor decides whether or not a particularsecurity is worth purchasing. The cut-off point is very subjective and will be basedon the personal characteristics of the individual investor.

Ri - Return on Security for a period (i)
Rf - Risk Free Return.
Rm - Expected Return.
β - Risk Premium.
σ_m^2 - Expected Return (or) Variance in the Market Index
σ_{ei}^2 - Unsystematic

$$C_i = \frac{\sigma_m^2 \sum_{i=1}^{N} \frac{(R_i - R_f)}{\sigma_{ei}^2} \times \beta_i}{1 + \sigma_m^2 \sum_{i=1}^{N} \frac{\beta_i^2}{\sigma_{ei}^2}}$$

Proportion of allotment in each security

It is done by evaluating the cut-off point then estimating the proportion to beinvested in each security using the following formula:

$$X_i = \frac{Z_i}{\sum_{i=1}^{N} Z_i}$$

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2}\left[\left(\frac{R_i - R_f}{\beta_i}\right) - C^*\right]$$

X i - Proportion of investment in individual security
Ri - Expected return of individual security
Rf - Risk free rate of return
βi - Systematic risk
C - Cut off point
σei^2 - Unsystematic risk

Sharpe's Performance Index

Sharpe ratio is the measure of risk adjusted return of a financial portfolio. The measure was named after William F Sharpe who developed it in 1966. It is a measure of excess portfolio return over the risk-free rate relative to its standard deviation. A portfolio with a higher Sharpe ratio is considered superior relative to its peers.

The standard deviation helps to show how much the portfolio's return deviates from the expected return. In simple terms, it shows how much additional return an investor earns by taking additional risk. In order to compensate for the higher standard deviation, the fund needs to generate a higher return to maintain a higher Sharpe ratio. Sharpe ratio is calculated by subtracting the risk-free rate from the return of the portfolio. The result will be divided by the standard deviation of the portfolio's excess return.

The standard deviation also sheds light on the portfolio's volatility. The Sharpe ratio characterizes how well the return of an asset compensates the investor for the risk taken. When comparing two assets versus a common benchmark, the one with a higher Sharpe ratio provides better return for the same risk or equivalently the same return for lower risk.

x -The investment portfolio $\quad S(x)=StdDev(r_x)\ (r_x-R_f)$

r_x -The average rate of return of the portfolio

xR_f -The best available rate of return of a risk-free security (*i.e.*, T-bills)

StdDev (r_x)-The standard deviation of $r_{x\backslash}$

The greater a portfolio's Sharpe ratio, the better its risk-adjusted-performance. If the analysis results in a negative Sharpe ratio, it either means the risk-free rate is greater than the portfolio's return, or the portfolio's return is expected to be negative. In either case, a negative Sharpe ratio does not convey any useful meaning.

Analysis and Interpretation

Applying the Capital Asset Pricing Model

CAPM does not give a particular portfolio and weightage to investment in different securities. Whereas Sharpe model gives exact number of securities along with weightage for investment. For applying the Capital Pricing Model, we have to first calculate the average/mean return and slope/beta measure of the stock. Post which the NSE index 50 is analyzed using the CAPM model.

Interpretation of Tables 1 & 2 Before & After tables

From Table 1 overleaf, the Buy/Sell decision using Capital Asset Pricing Model (CAPM) has been obtained for the period **Before** COVID-19 Pandemic. Automobile sector and Media fell under sell decision. Banking, Commodities, FMCG, and pharmaceuticals sectors wavered.

From the Table 2, the Buy/Sell decision using Capital Asset Pricing Model (CAPM) has been obtained for the period **After** COVID-19 Pandemic. Commodities and Pharmaceutics sector fell under Buy decision. Banking sector fell under sell decision. Automobile, FMCG, and Media wavered.

Table 1 CAPM Analysis for the period **Before** COVID-19 Pandemic

INDUSTRY	S.NO	SYMBOL	Before Covid-19 Pandemic			
			Ri	Slope	CAPM	Decision
AUTOMOBILE	1	MARUTI	-0.38	1.13	-0.31	Sell
	2	BAJAJ-AUTO	-0.32	0.75	-0.19	Sell
	3	M&M	-0.77	0.97	-0.26	Sell
	4	EICHERMOT	-0.34	0.93	-0.25	Sell
	5	MOTHERSUMI	-0.75	1.33	-0.37	Sell
BANKING	6	HDFCBANK	-0.74	1.07	-0.29	Sell
	7	ICICIBANK	-0.13	1.26	-0.35	Buy
	8	KOTAKBANK	0.03	1.02	-0.28	Buy
	9	SBIN	-0.39	1.26	-0.35	Sell
	10	AXISBANK	-0.59	1.35	-0.38	Sell
COMMODITIES	11	RELIANCE	-0.14	1.16	-0.32	Buy
	12	ULTRACEMCO	-0.15	1.09	-0.30	Buy
	13	ADANIGREEN	1.56	0.71	-0.17	Buy
	14	JSWSTEEL	-0.58	1.33	-0.38	Sell
	15	HINDZINC	-0.55	0.76	-0.19	Sell
FMCG	16	HINDUNILVR	0.35	0.70	-0.17	Buy
	17	ITC	-0.49	0.81	-0.21	Sell
	18	NESTLEIND	0.44	0.64	-0.15	Buy
	19	DABUR	0.15	0.64	-0.15	Buy
	20	BRITANNIA	-0.06	0.89	-0.23	Buy
MEDIA	21	ZEEL	-0.98	0.81	-0.21	Sell
	22	SUNTV	-0.69	1.10	-0.30	Sell
	23	PVR	-0.26	0.75	-0.19	Sell
	24	TV18BRDCST	-0.67	1.16	-0.32	Sell
	25	NETWORK18	-0.79	1.01	-0.27	Sell
PHARMACEUTICALS	26	SUNPHARMA	-0.24	0.68	-0.16	Sell
	27	DIVISLAB	0.19	0.57	-0.13	Buy
	28	DRREDDY	0.15	0.47	-0.09	Buy
	29	CIPLA	-0.17	0.49	-0.10	Sell
	30	AUROPHARMA	-0.48	1.16	-0.32	Sell

Table 2 CAPM analysis for the period **After** COVID-19 Pandemic

INDUSTRY	S No	SYMBOL	After Covid-19 Pandemic			
			Ri	Slope	CAPM	Decision
AUTOMOBILE	1	MARUTI	0.55	1.18	0.70	Sell
	2	BAJAJ-AUTO	0.64	0.90	0.55	Buy
	3	M&M	1.17	1.28	0.75	Buy
	4	EICHERMOT	0.14	0.89	0.54	Sell
	5	MOTHERSUMI	1.41	1.44	0.84	Buy
BANKING	6	HDFCBANK	0.65	1.25	0.73	Sell
	7	ICICIBANK	0.74	1.76	1.01	Sell
	8	KOTAKBANK	0.46	1.12	0.67	Sell
	9	SBIN	0.76	1.30	0.76	Sell
	10	AXISBANK	0.80	1.79	1.03	Sell
COMMODITIES	11	RELIANCE	0.68	0.94	0.57	Buy
	12	ULTRACEMCO	0.81	0.88	0.54	Buy
	13	ADANIGREEN	2.11	0.47	0.32	Buy
	14	JSWSTEEL	1.27	1.26	0.74	Buy
	15	HINDZINC	0.63	0.47	0.32	Buy
FMCG	16	HINDUNILVR	0.14	0.49	0.33	Sell
	17	ITC	0.32	0.47	0.31	Buy
	18	NESTLEIND	0.13	0.49	0.33	Sell
	19	DABUR	0.25	0.51	0.33	Sell
	20	BRITANNIA	0.38	0.47	0.31	Buy
MEDIA	21	ZEEL	0.68	1.43	0.83	Sell
	22	SUNTV	0.62	0.84	0.52	Buy
	23	PVR	0.30	1.01	0.60	Sell
	24	TV18BRDCST	0.80	0.93	0.57	Buy
	25	NETWORK18	0.82	0.73	0.46	Buy
PHARMACEUTICALS	26	SUNPHARMA	0.61	0.57	0.37	Buy
	27	DIVISLAB	0.71	0.59	0.38	Buy
	28	DRREDDY	0.43	0.44	0.30	Buy
	29	CIPLA	0.74	0.41	0.29	Buy
	30	AUROPHARMA	0.90	0.53	0.35	Buy

Paired T -test

There exists significant difference between CAPM, Beta and the Buy Sell Decisions taken before COVID and After COVID. Implies the choice of assets or stocks have completely changed due to disturbance in the market.

Table 3 Paired T test for **Before and After** COVID

CAPM - Paired Samples Test				
		T	Df	Sig. (2-tailed)
1	Buy Sell Before & After	1.756	29	.090*
2	CAPM Before – After	-14.989	29	.000**
3	Beta Before – After	-26.629	29	.000**
*Significant at 10% ** Significant at 1%				

Analysis of Sharpe's Single Index Model

From within the selected stock an optimal portfolio has been constructed using Sharpe's Single Index Model with the help of Cut-off rate (Ci). From the above tables the selected stocks from NSE are sorted in to rank order with respect to the ratio of excess return to beta measure for both periods.

Table 4 Ranks for Ratio of **Excess Return to Beta Before & After** COVID-19 Pandemic

Before Covid-19 Pandemic

INDUSTRY	SYMBOL	Ri	β	σ^2_{ei}	Ri-Rf/β	Rank
COMMODITIES	ADANIGREEN	1.56	0.71	0.34	2.11	1
FMCG	NESTLEIND	0.44	0.64	0.05	0.6	2
FMCG	HINDUNILVR	0.35	0.7	0.05	0.41	3
PHARMACEUTICALS	DIVISLAB	0.19	0.57	0.07	0.23	4
PHARMACEUTICALS	DRREDDY	0.15	0.47	0.06	0.19	5
FMCG	DABUR	0.15	0.64	0.04	0.14	6
BANKING	KOTAKBANK	0.03	1.02	0.04	-0.03	7
FMCG	BRITANNIA	-0.06	0.89	0.07	-0.14	8
BANKING	ICICIBANK	-0.13	1.26	0.05	-0.15	9
COMMODITIES	RELIANCE	-0.14	1.16	0.07	-0.17	10
COMMODITIES	ULTRACEMCO	-0.15	1.09	0.05	-0.19	11

After Covid-19 Pandemic

INDUSTRY	SYMBOL	Ri	β	σ^2_{ei}	Ri-Rf/β	Rank
COMMODITIES	ADANIGREEN	2.11	0.47	0.24	4.31	1
PHARMACEUTICALS	CIPLA	0.74	0.41	0.12	1.64	2
PHARMACEUTICALS	AUROPHARMA	0.9	0.53	0.18	1.58	3
COMMODITIES	HINDZINC	0.63	0.47	0.19	1.2	4
PHARMACEUTICALS	DIVISLAB	0.71	0.59	0.09	1.1	5
MEDIA	NETWORK18	0.82	0.73	0.22	1.05	6
COMMODITIES	JSWSTEEL	1.27	1.26	0.09	0.96	7
PHARMACEUTICALS	SUNPHARMA	0.61	0.57	0.1	0.95	8
AUTOMOBILE	MOTHERSUMI	1.41	1.44	0.22	0.93	9
AUTOMOBILE	M&M	1.17	1.28	0.12	0.87	10
COMMODITIES	ULTRACEMCO	0.81	0.88	0.06	0.85	11
PHARMACEUTICALS	DRREDDY	0.43	0.44	0.1	0.84	12
MEDIA	TV18BRDCST	0.8	0.93	0.29	0.79	13
FMCG	BRITANNIA	0.38	0.47	0.05	0.68	14
MEDIA	SUNTV	0.62	0.84	0.12	0.66	15
COMMODITIES	RELIANCE	0.68	0.94	0.08	0.66	16
AUTOMOBILE	BAJAJ-AUTO	0.64	0.9	0.07	0.64	17
FMCG	ITC	0.32	0.47	0.08	0.55	18

Creating the Portfolio

There are just two stocks ADANIGREEN from commodities and NESTLEIND from FMCG ranking 1 and 2 were selected for the optimal portfolio. The proportion of investment to be made in ADANIGREEN is 100% and the NESTLEIND is was negative.

ADANIGREEN from commodities and CIPLA from Pharmaceuticals ranking 1 and 2 wereselected for the optimal portfolio. The proportion of investment to be made in ADANIGREEN is 96.990% and the CIPLA is 3.0095%. So that the optimal portfolio has only these two.

Table 6 Cut off Rate Calculation Before & After

INDUSTRY	SYMBOL	Before COVID-19 Pandemic			
		β^2/σ^2_{ei}	$\Sigma\beta^2/\sigma^2_{ei}$	$1+\sigma^2_m*\Sigma\beta^2/\sigma^2_{ei}$	Ci
Commodities	ADANIGREEN	1.502	1.502	0.597	-1.426
FMCG	NESTLEIND	8.335	9.837	-1.638	1.334
FMCG	HINDUNILVR	10.109	19.945	-4.349	**0.760**
Pharmaceuticals	DIVISLAB	4.575	24.521	-5.577	0.644
Pharmaceuticals	DRREDDY	3.693	28.214	-6.567	0.575
FMCG	DABUR	9.904	38.118	-9.223	0.451
Banking	KOTAKBANK	23.352	61.470	-15.487	0.256
FMCG	BRITANNIA	11.926	73.396	-18.685	0.189
Banking	ICICIBANK	34.979	108.376	-28.067	0.076
Commodities	RELIANCE	19.383	127.759	-33.266	0.038

INDUSTRY	SYMBOL	After COVID-19 Pandemic			
		β^2/σ^2_{ei}	$\Sigma\beta^2/\sigma^2_{ei}$	$1+\sigma^2_m*\Sigma\beta^2/\sigma^2_{ei}$	Ci
Commodities	ADANIGREEN	0.950	0.950	1.571	1.567
Pharmaceuticals	CIPLA	1.436	2.387	2.435	1.592
Pharmaceuticals	AUROPHARMA	1.602	3.989	3.398	**1.588**
Commodities	HINDZINC	1.185	5.174	4.111	1.521
Pharmaceuticals	DIVISLAB	3.740	8.914	6.360	1.371
Media	NETWORK18	2.434	11.348	7.823	1.310
Commodities	JSWSTEEL	18.354	29.703	18.858	1.104
Pharmaceuticals	SUNPHARMA	3.445	33.148	20.930	1.089
Automobile	MOTHERSUMI	9.577	42.724	26.688	1.055
Automobile	M&M	13.416	56.140	34.754	1.011

Portfolio Before and After

Table 7 Optimal **Portfolio Before & After** COVID-19

INDUSTRY	SYMBOL	Before COVID-19 Pandemic	
		Zi	Xi
Commodities	ADANIGREEN	2.86271318	100%
FMCG	NESTLEIND	-2.131290615	0
		2.86271318	100%

INDUSTRY	SYMBOL	After COVID-19 Pandemic	
		Zi	Xi
Commodities	ADANIGREEN	5.448124763	96.990%
Pharmaceuticals	CIPLA	0.169051393	3.0095%
Pharmaceuticals	AUROPHARMA	0.000651342	0
		5.617176156	100%

Sharpe's Performance Index

Table 8 Analysis of Portfolio Performance Before & After COVID-19

VARIABLE	FORMULA	RESULT
Portfolio Return (R_p)	$R_p=\Sigma(X_i*R_i)$	2.862713
Portfolio Variance (σ_p^2)	$\sigma_p^2 = [(\Sigma X_i\beta_i) \wedge 2 * \sigma] + [(\Sigma X_m^2 *2\sigma 2e_i)]$	0.200459
Portfolio Risk (σ_p)	Sqrt $(\sigma_p)^2$	0.447726
Portfolio Beta (β_p)	$\beta_p = \Sigma (\beta_i*X_i)$	0.710094

VARIABLE	FORMULA	RESULT
Portfolio Return (R_p)	$R_p=\Sigma(X_i*R_i)$	5.289249
Portfolio Variance (σ_p^2)	$\sigma_p^2 = [(\Sigma X_i\beta_i) \wedge 2 * \sigma] + [(\Sigma X_m^2 *2\sigma 2e_i)]$	0.357607
Portfolio Risk (σ_p)	Sqrt $(\sigma_p)^2$	0.598003
Portfolio Beta (β_p)	$\beta_p = \Sigma (\beta_i*X_i)$	0.472877

Table 9 Sharpe's Portfolio Performance Index

Portfolio	Rp	Rf	σp	Sharpe's Performance Index (St) = (Rp-Rf)/σp
Before COVID-19	2.86271318	0.05937	0.447726	6.261291
After COVID-19	5.289248722	0.06247	0.598003	8.740395

From table 9 it can be inferred that Portfolio Before COVID-19 Pandemic has Sharpe value of 6.261291 and Portfolio After COVID-19 Pandemic has Sharpe value of 8.740395.

Findings & Conclusion

Average/Mean Returns and Beta value

From the average/mean return, the ADANIGREEN has the highest mean return of 156.01% and the ZEEL has the lowest mean return of -97.79% in the period of Before COVID-19 Pandemic.

ADANIGREEN has the highest mean return of 210.81% and the EICHERMOTOR has the lowest mean return of -13.87% in the period of After COVID-19 Pandemic.

For the period of Before COVID-19 Pandemic, the companies having beta value greater than 1 are MARUTI, MOTHERSUMI, HDFCBANK, ICICIBANK, KOTAKBANK, SBIN, AXISBANK, RELIANCE, ULTRACEMCO, JSWSTEEL, SUNTV, TV18BRDCST, NETWORK18, and AUROPHARMA. So, the companies are defined as highly volatile stocks.

The companies having beta value lesser than 1 are BAJAJ-AUTO, M&M, EICHERMOT, ADANIGREEN, HINDZINC, HINDUNILVR, ITC, NESTLEIND, DABUR, BRITANNIA, ZEEL, PVR, SUNPHARMA, DIVISLAB, DRREDDY, and CIPLA. So, the companies are defined as low volatile stocks.

For the period of After COVID-19 pandemic, the companies having beta value greater than 1 are MARUTI, M&M, MOTHERSUMI, HDFCBANK, ICICIBANK,KOTAKBANK, SBIN, AXISBANK, JSWSTEEL, ZEEL, and PVR. So, the companies are defined as highly volatile stocks.

The companies having beta value lesser than 1 are BAJAJ-AUTO, EICHERMOT, RELIANCE, ULTRACEMCO, ADANIGREEN, HINDZINC, HINDUNILVR, ITC, NESTLEIND, DABUR, BRITANNIA, SUNTV, TV18BRDCST, NETWORK18. SUNPHARMA, DIVISLAB, DRREDDY, CIPLA, and AUROPHARMA. So, the companies are defined as low volatile stocks.

Capital Asset Pricing Model (CAPM)

The result of CAPM shows emphasis only on the individual security. It shows that some securities are overpriced and some are underpriced. The securities which are underpriced suggest that investors should invest in these underpriced securities as there are chances of return to be increased in the future. Whereas the securities which are overpriced indicate that they should not be purchased by investors as it is overvalued.

CAPM Before COVID -19 Pandemic

It is found that out of the 50 stocks considered for study, 11 securities are undervaluedand will be profitable for the investor if they invest in them. These are ICICIBANK, KOTAKBANK, RELIANCE, ULTRACEMCO, ADANIGREEN, HINDUNILVR, NESTLEIND, DABUR, BRITANNIA, DIVISLAB, and DRREDDY.

CAPM After COVID-19 Pandemic

It is found that out of 50 stocks considered for study, 18 securities are undervaluedand will be profitable for the investor if they invest in them. These eighteen securities are BAJAJ-AUTO, M&M, MOTHERSUMI, RELIANCE, ULTRACEMCO, ADANIGREEN, JSWSTEEL, HINDZINC, ITC, BRITANNIA, SUNTV, TV18BRDCST, NETWORK18, SUNPHARMA, DIVISLAB, DRREDDY, CIPLA, and AUROPHARMA.

Sharpe's Single Index Model (SIM)

The selection of the stocks depends on a unique cut-off rate such that all stocks with higherratios of excess return to beta are included and stocks with lower ratio are left out. The cumulated values of Ci start declining after a particular Ci and that point is taken as the cut-off point and that stock ratio is the Cut-off Ratio C. The highest value of Ci is taken as thecut-off point that is C*. All the stocks having Ci greater than C* can be included in the portfolio.

The result of Index Model for the portfolios both Before and After COVID-19 Pandemic shows that out of 30 securities selected for the portfolio construction, 2 securities were selected for the optimal portfolio construction as they had higher Ci than C* of their respective portfolios.

SIM Before Covid-19 Pandemic

It is found that out of 50 stocks selected for study, only 2 stocks are chosen for inclusion in optimal portfolio. The excess return to beta ratio of only 2 stocks has C_i greater than C* which is 0.760108782. The securities ranking from 1 to 2 are selected for optimal portfolio.

The two securities and proportion of investment to be made are ADANIGREEN is100%, and the other selected stock is NESTLEIND which has negative Z_i value of -2.13, so that it is neglected and the optimal portfolio is constructed with a single stock to get maximum return by neglecting the portfolio risk.

SIM After Covid-19 Pandemic

It is found that out of 50 stocks selected for study, only 2 stocks are chosen for inclusion in optimal portfolio. The excess return to beta ratio of only 2 stocks has C_i greater than C* which is 1.587914573. The securities ranking from 1 to 2 are selected for optimal portfolio.

The two securities and proportion of investment to be made are ADANIGREEN is96.9905%, and CIPLA is 3.0095%. with these two stocks the portfolio is constructed optimally to get maximum return by minimum portfolio risk.
From the decisions obtained from the CAPM model the investors can go for the investment in the pharmaceuticals industry and commodities because the stocks under those two sectors are under-priced and may expect steep rise in future

Comparison of CAPM and Sharpe's Single Index Model

For the period before COVID-19 Pandemic, only one stock has been selected for the optimal portfolio construction which has been constructed with Sharpe's SingleIndex Model and by comparing it with the decision obtained from CAPM is clearlyquoted that the selected stock is resulted as strong buy decision.

For the period After COVID-19 Pandemic, there are two stocks has been selected for the optimal portfolio construction which has been constructed with Sharpe's Single Index Model and by comparing it with the decision obtained from CAPM isclearly quoted that the selected stocks as resulting strongly as buy decision.

Sharpe's Performance Index

For the period Before COVID-19 Pandemic, the overall portfolio return (R_p) is 2.862713 or 286.2713%, the portfolio risk (σ_p) is 0.447726, the portfolio beta (βp) is 0.472877, and the Sharpe's performance index is 6.261291.

By constructing the portfolio with 100% of ADANIGREEN has obtained the portfolio return of 286.2713%, which means that an investor gets an amount of 286.2713% of portfolio return by bearing 0.447726 portion of portfolio risk.

For the period After COVID-19 Pandemic, the overall portfolio return (R_p) is 5.289249 or 528.9249%, the portfolio risk (σ_p) is 0.598003, the portfolio beta (βp) is 0.472877, and the Sharpe's performance index is 8.740395.

By constructing the portfolio with 96.990% of ADANIGREEN and 3.0095% of CIPLA had obtained the portfolio return of 528.9249% of portfolio return by bearing 0.598003 portion of portfolio risk.

From the comparison of Sharpe's Single Index Model and Capital Asset Pricing Model, an investor should hold portfolio of equities suggested by Sharpe Model rather than CAPM model.

According to Sharpe's Performance Index the portfolio constructed after COVID- 19 Pandemic has greater index value of 8.740395 than the portfolio constructed before COVID-19 Pandemic with the index value of 6.261291.

The study reveals that both the portfolios have a positive risk adjusted returns. As higher the risk adjusted return value, the better the portfolio, Portfolio constructed After COVID-19 Pandemic has high risk adjusted return value.

So, it is clear that our hypothesis has a clear result that there is a significant impact of COVID-19 Pandemic in the Indian stock market.

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