

CONSTRUCTION OF AN OPTIMAL PORTFOLIO USING THE SINGLE INDEX MODEL: AN EMPIRICAL STUDY OF PRE AND POST COVID 19

Dr. Karthik Reddy¹, Mrs. Lakshmi. S N², Dr. S. Thilaga³, Mr. Mahabub Basha⁴

¹Assistant Professor, Department of Management Studies, Nitte Meenakshi Institute of Technology, Bengaluru.
E-mail: mbaskreddy@gmail.com

²Assistant Professor, Koshys Institute of Management studies, Bangalore.
E-mail: lakshmi.sn@kgi.edu.in

³Assistant Professor, Department of Management Studies, Coimbatore Institute of Technology, Coimbatore, Tamilnadu.
E-mail: thilaga.s@cit.edu.in

⁴Assistant Professor, Department of Commerce, IIBS, Bangalore.
E-mail: Shaiks86@gmail.com

DOI: 10.47750/pnr.2023.14.03.51

Abstract

The financial markets have been significantly influenced by Covid19. Investors have reallocated their portfolios as a result of changing expectations for risk and return. In both academia and industry, building a portfolio via wise stock selection has been seen as a problem. The stock market's inherent uncertainties are to blame for this. Stock selection in a portfolio is impacted by anticipated price movement. The predictability of stock price changes has been disputed for a very long time, however. The random walk hypothesis (Fama, 1995) states that since stock price changes are unpredictable and lack memory, the past cannot foretell the future. Therefore, if the market is efficient, the stock price at the moment represents all the information. Since insider trading is required, it is impossible to outperform the market and is compatible with EMH. Therefore, the quest for effective forecasting techniques does not lead to consistent, long-term trends that can be predicted. According to the findings, investors have begun redistributing their portfolios across other equities in response to the current financial crisis related to COVID-19. But not all investors experience the same situation when switching from risky to risk-free investments.

Key words: Optimal portfolio, NSE, Cut-off rate, Securities, Beta, Covid19.

Introduction

Due to the intensity of the spread, COVID-19 was first deemed a global health emergency by the World Health Organization (WHO, 2020) on January 30, 2020, and then a pandemic on March 11, 2020. The outbreak is unusual since it is fundamentally different from any other epidemics in that it is extremely infectious. The prevalence of COVID-19 infection. The most difficult lockdown choices have been made as a result by governments all across the globe. Lockdowns have been used since the outbreak as a containment tactic, initially rigidly and then more laxly. This has had an impact on human activity and has almost brought the economy to its knees. It is predicted that between 0.1% and 0.4% of global GDP will be lost in 2020, which would cause the economy to contract (Abdul & Mia, 2020). The results of research on the pandemic's effects indicate that almost every other economic area in the world is affected.

Markets have been glooming in dread and uncertainty since the COVID 19 struck. It has caused markets all across the globe to plunge to depths unseen since the 2008 Global Financial Crisis. BSE Sensex and Nifty 50 both plummeted by 38% in response to the market's high connection with trends and indicators worldwide. Since the year's beginning, the entire Market Capitalization has dropped a startling 27.31%. The stock market has mirrored the emotions that this epidemic unleashed among investors, both local and international. There has been very little growth over the last several months as a consequence of companies cutting down, an increase in layoffs, and changes to employee remuneration. The stock prices of corporations in several industries, including hospitality, travel, and entertainment, have fallen more than 40% as a result.

When it comes to maximizing returns on their investments for a given amount of risk, rational investors with limited cash may now do so by investing in the Indian stock market. There are various levels of risk in every financial choice. The relationship between return and risk has become more important for achieving the best stock allocation, the best investing strategy, or even for evaluating market anomalies for anomalous stock returns over a period of time (Nath and Dalvi 2004).

As a result, for more than three decades, portfolio analysis has continued to be one of the most active fields of financial economics study. More subtly, this gives the investor the option of taking a judicious move or exercising caution by being idle, which forces the investor to consider the asset's inherent connection between risk and return. Investor views regarding portfolios are solely based on projected return and risk in the actual world, where we aim to evaluate the standard deviation as a proxy or surrogate to risk (Markowitz 1959). Since diverse portfolios decrease the likelihood of unsystematic risk, it is very difficult for investors to avoid systematic risk.

A Financial portfolio which contain too many stocks then it's difficult to manage the risk and return, the transaction cost will increase, it's require good managerial ability which was difficult so adequate number stocks in a portfolio is between 10 to 20 stocks. The creation of the ideal portfolio is facilitated by placing the most focus on portfolio analysis and selection. On the topic of portfolio, not much is spoken. It is just as crucial to revise as it is to analyze and choose your portfolio. Market changes in the financial sector are ongoing. A portfolio may stop being optimum over time in this changing environment if it was optimal when it was first built. In order to maintain its ideal state, it may need to be altered on occasion.

Review of Literature

Brooks & A. Katsaris (2003) mentioned whether this variability could be explained by reference to a speculative bubble. Three empirical differences Methodologies used: testing of variance limits, testing of bubble specifications, and co integration checks based on data from both ex-post and ex pre. We see why stock prices do in the last six years, they diverged dramatically from their fundamental beliefs, and that this differentiation has all the critical characteristics of a bubble.

Samir Khan (2012) examined the research on a few Indian industrial stocks. Secondary has gathered data from 2003 to 2012 throughout a ten-year period. 14 equities from five distinct industrial sectors made up the sample size. 6.5% of the asset is taken risk free. According to the study's analysis, investors have opportunities based on the returns produced by certain equities. The analysis of this research sample was constrained. That may not have an impact on an ideal portfolio of stocks from certain industries. The effects of correlation between various industrial sectors were studied. The goal of an ideal portfolio is to balance the positive and negative variance that currently exists between the assets and provide superior returns. Only 3 of the 14 equities are suitable for building an ideal portfolio. This might be advantageous to investors and periodic portfolio rebalancing. previously conducted research on optimum portfolio analysis.

R. Nalini (2014) explained the single index methodology used with a few BSE equities. The study's objective is to get practical understanding of the single index model. Data has been gathered between 2009 and 2014. The analysis used fifteen prescriptions' monthly closing prices. Only four firms out of fifteen equities are featured in the portfolio. It was discovered that high return equities usually point to portfolio volatility. Before making any

investing decisions, this should be taken into consideration. When returns are high, the risk associated with a certain script should be taken into consideration for investing purposes, according to the report. According to a study, the bulk of the funds may only buy one kind of stock. Study optimization of portfolio development would have worked better. The majority of the money are being used to invest in this particular stock, which may be high risk. In a study, it was examined how to make investors aware of the Sharpe index model. The risk analysis that was conducted can be diversified if a portfolio of mixed high-return equities is created. Micro level studies have a greater influence on fund managers' ability to make wise investment decisions, according to the research paper's conclusion.

Chauhan (2014) put up a portfolio utilizing the top 10 NIFTY equities. It was discovered in the research that calculating an ideal portfolio may be done quickly and easily. Less variables are employed in this strategy than in the Markowitz Model. It is known as the Single Index Model since it only builds portfolios using one index.

Gopalakrishnan (2014) He found a substantial link between the IT index and the S&P and Nifty in his analysis of 13 actively traded NSE IT Index scrips. The majority of the IT companies were discovered to be cheap in relation to current market levels, and investors may want to consider adding these firms to their portfolios. Vardarajan (n.d.) came to the conclusion that SIM serves as a tool for portfolio selection and aids investors in making wise judgments after studying 20 companies from the steel, banking, and media and entertainment sectors. Because of the erratic nature of the stock market, investors must periodically review and adjust their holdings.

Mohammed (2019) has out a research named The Construction of Optimum Portfolio Using Sharpe's Index Model—A Study With Reference To Selected Companies of BSE Sensex. Ten chosen businesses from five different industries were shown in the results. Only 2 of these chosen firms were involved in the 2-year period from January 2015 to December 2016.

Objectives of the study

- To comprehend the functioning of the Indian stock market, especially as it relates NSE 50 stocks in pre- and post-COVID-19
- To use a single index model to determine the ideal portfolio.
- To calculate the percentage of investments in the ideal portfolio

Research Methodology

To cover every element of the investigation, secondary data has been gathered. The secondary data displays month-by-month pre- and post-COVID-19 bourse statistics for the Indian stock market. The information is gathered between April 2019 and March 2022. 50 NSE stocks are included in the sample size, and the risk-free rate is 7.1% (based on Treasury bills).

Theoretical Framework

Sharpe has offered a technique for choosing the right assets for an ideal portfolio. Co-relate each security with the efficient market value weighted portfolio of all risky assets in the universe as opposed to an index of all the securities included in the study. The following stages are included in the portfolio creation process.

Below are the processes for determining the stocks to be included in the ideal portfolio.

(i) For each stock you're thinking about, determine its "Excess Return to Beta" ratio.

$$\text{Excess Return to Beta Ratio} = \frac{R_i - R_f}{\beta_i}$$

(ii) Sort them in order of highest to lowest. Use the following formula to compute C_i for all stocks/portfolios in the ranking order.

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

Where,

σ_m^2 = Variance of the return of market index.

σ_{ei}^2 = Variance of the stock's movement that is not associated with the movement of market index i.e. stocks unsystematic risk.

(i) Determine the cutoff point, when C_i has the largest value and C^* is taken. All stocks with excess return to risk ratios below the cut-off ratio are rejected, while those with ratios over the cut-off ratio are chosen. The key justification for this choice is that because securities are listed from maximum excess return to lowest beta, if a given asset is part of an ideal portfolio, all securities at the top of the list are also part of that portfolio.

(ii) After determining which stocks should be a part of the ideal portfolio, we will use the following formula to determine the percentage that should be invested in each security.

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

Where,

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

To guarantee that all funds are invested, the first section weights each stock according to its value, and the second portion calculates the proportionate investment in each security.

Data Analysis and Interpretation

Step: 1 Mean return, Beta and Standard deviation

S.No	Company	Ri	β_i	SD (σ)
1	SBIN	46%	1.44	1.33
2	M&M	21%	1.89	1.88
3	POWERGRID	14%	1.83	1.12
4	ULTRACEMCO	11%	1.84	1.23
5	ADANI PORTS	36%	1.86	1.59

6	EICHERMOT	25%	1.91	1.48
7	BPCL	18%	1.47	2.35
8	JSWSTEEL	35%	1.96	1.47
9	HEROMOTOCO	13%	2.67	2.47
10	ITC	41%	0.71	2.03
11	TITAN	36%	2.01	1.54
12	ADANIENT	81%	3.85	2.08
13	TATAMOTORS	18%	1.95	1.65
14	UPL	9%	2.46	1.91
15	ICICIBANK	7%	2.03	1.12
16	NTPC	11%	2.65	2.11
17	MARUTI	12%	3.08	2.08
18	APOLLOHOSP	3%	1.99	1.07
19	TATASTEEL	34%	1.11	2.43
20	KOTAKBANK	34%	2.14	1.71
21	LT	6%	2.15	1.49
22	HINDUNILVR	11%	2.11	1.76
23	DRREDDY	18%	1.75	1.91
24	BHARTIARTL	37%	2.79	1.22
25	ONGC	42%	0.91	2.01
26	AXISBANK	12%	2.52	1.13
27	BAJAJFINSV	34%	2.36	1.11
28	RELIANCE	9%	2.15	2.51
29	INFY	39%	1.65	1.21
30	BAJAJ-AUTO	17%	2.48	1.19
31	COALINDIA	16%	0.96	1.32
32	GRASIM	22%	2.99	0.99
33	INDUSINDBK	11%	2.11	1.88
34	HDFCBANK	22%	1.46	2.12
35	NESTLEIND	32%	1.62	1.22
36	HINDALCO	14%	1.45	1.66

37	HDFC	56%	2.14	1.77
38	TATACONSUM	1%	2.38	1.53
39	WIPRO	7%	1.75	1.83
40	HCLTECH	1%	2.53	2.2
41	SBILIFE	41%	1.17	1.78
42	DIVISLAB	15%	1.25	2.71
43	ASIANPAINT	51%	2.35	2.88
44	SUNPHARMA	15%	1.56	2.13
45	CIPLA	9%	1.71	2.09
46	HDFCLIFE	16%	1.23	2.01
47	BRITANNIA	12%	2.29	1.83
48	TECHM	6%	2.26	1.91
49	TCS	14%	1.51	2.81
50	BAJFINANCE	18%	2.51	2.83

Source: Computed data

Calculations for mean, beta, and standard deviation are shown in Table 1. The company with the best returns was Adani Enterprises, followed by HDFC and Asian Paints Beta values, on the other hand, vary from 0.71 to 3.68. It is important to keep in mind that if the value of Beta is greater than one, it means the stock is extremely volatile and more sensitive to market return; any small change in market return influences the stock prices more significantly than would be expected given the size of the change in the market return. The table shows that 47 equities have beta values greater than 1.

Step 2: Calculation of Excess Return to Beta Ratio and Raking the Scripts

S.No	Company	Ri	β_i	SD (σ)	(σ_i^2)	Ri-Rf	Ri-Rf/ β_i	Rank
1	SBIN	46%	1.44	1.33	0.00835	0.39	0.2708	4
2	M&M	21%	1.89	1.88	0.01429	0.14	0.0741	21
3	POWERGRID	14%	1.83	1.12	0.01031	0.07	0.0383	32
4	ULTRACEMCO	11%	1.84	1.23	0.00597	0.04	0.0217	35
5	ADANI PORTS	36%	1.86	1.59	0.00752	0.29	0.1559	10
6	EICHERMOT	25%	1.91	1.48	0.00708	0.18	0.0942	18
7	BPCL	18%	1.47	2.35	0.01384	0.11	0.0748	20
8	JSWSTEEL	35%	1.96	1.47	0.00672	0.28	0.1429	13
9	HEROMOTOCO	13%	2.67	2.47	0.01848	0.06	0.0225	33

10	ITC	41%	0.71	2.03	0.01014	0.34	0.4789	15
11	TITAN	36%	2.01	1.54	0.00738	0.29	0.1443	12
12	ADANIENT	81%	3.85	2.08	0.00954	0.74	0.3822	2
13	TATAMOTORS	18%	1.95	1.65	0.00912	0.11	0.0564	25
14	UPL	9%	2.46	1.91	0.00994	0.02	0.0081	43
15	ICICIBANK	7%	2.03	1.12	0.00273	0.00	0.0000	44
16	NTPC	11%	2.65	2.11	0.01167	0.04	0.0151	40
17	MARUTI	12%	3.08	2.08	0.02145	0.05	0.0162	39
18	APOLLOHOSP	3%	1.99	1.07	0.00539	0.04	0.0201	48
19	TATASTEEL	34%	1.11	2.43	0.01371	0.27	0.2432	5
20	KOTAKBANK	34%	2.14	1.71	0.00886	0.27	0.1262	14
21	LT	6%	2.15	1.49	0.00598	0.01	0.0047	47
22	HINDUNILVR	11%	2.11	1.76	0.00593	0.04	0.0190	37
23	DRREDDY	18%	1.75	1.91	0.00784	0.11	0.0629	24
24	BHARTIARTL	37%	2.79	1.22	0.01284	0.30	0.1075	16
25	ONGC	42%	0.91	2.01	0.00779	0.35	0.1846	8
26	AXISBANK	12%	2.52	1.13	0.00462	0.05	0.0198	36
27	BAJAJFINSV	34%	2.36	1.11	0.00772	0.27	0.4944	1
28	RELIANCE	9%	2.15	2.51	0.02243	0.02	0.0093	42
29	INFY	39%	1.65	1.21	0.00506	0.32	0.1939	7
30	BAJAJ-AUTO	17%	2.48	1.19	0.00525	0.10	0.0403	31
31	COALINDIA	16%	0.96	1.32	0.00513	0.09	0.0938	19
32	GRASIM	22%	2.99	0.99	0.00637	0.15	0.0502	27
33	INDUSINDBK	11%	2.11	1.88	0.00961	0.04	0.0190	37
34	HDFCBANK	22%	1.46	2.12	0.01021	0.15	0.1027	17
35	NESTLEIND	32%	1.62	1.22	0.00526	0.25	0.1543	11
36	HINDALCO	14%	1.45	1.66	0.02209	0.07	0.0483	28
37	HDFC	56%	2.14	1.77	0.05053	0.49	0.2290	6
38	TATACONSUM	1%	2.38	1.53	0.00437	0.06	0.0252	50
39	WIPRO	7%	1.75	1.83	0.00652	0.00	0.0000	44
40	HCLTECH	1%	2.53	2.2	0.00848	0.06	0.0237	49

41	SBILIFE	41%	1.17	1.78	0.00891	0.34	0.2906	3
42	DIVISLAB	15%	1.25	2.71	0.02101	0.08	0.0640	23
43	ASIANPAINT	51%	2.35	2.88	0.00658	0.44	0.1872	9
44	SUNPHARMA	15%	1.56	2.13	0.00489	0.08	0.0513	26
45	CIPLA	9%	1.71	2.09	0.00694	0.02	0.0117	41
46	HDFCLIFE	16%	1.23	2.01	0.01036	0.09	0.0732	22
47	BRITANNIA	12%	2.29	1.83	0.00856	0.05	0.0218	34
48	TECHM	6%	2.26	1.91	0.00495	0.01	0.0044	46
49	TCS	14%	1.51	2.81	0.00442	0.07	0.0464	29
50	BAJFINANCE	18%	2.51	2.83	0.00899	0.11	0.0438	30

Source: Computed data

Calculation of excess return to beta ratio and rankings is shown in Table 2. Excess return is the difference between the mean return and the return on risk-free assets. Adani Enterprises (38%) and SBI Life (49%) have the largest excess return to beta ratios, respectively (295). We know that all highly rated scripts are part of the ideal portfolio since scripts are sorted from highest to lowest excess return to beta ratio. By diversifying their investments, investors may lower their risk. Tata Consumers reported the lowest risk (0.00437) ever.

Step 3: Calculation of Cut of rate

S.No	Company	$(R_i - R_f) * \beta_i / \sigma_{e_i}^2$	$\Sigma(R_i - R_f) * \beta_i / \sigma_{e_i}^2$	$\beta_i / \sigma_{e_i}^2$	Ci
1	SBIN	0.7708	0.7708	1.5591	0.0101
2	ADANI PORTS	0.1559	1.0608	2.1758	0.0117
3	ITC	0.4789	1.8741	0.2483	0.0121
4	ADANI ENT	0.3822	2.4006	7.1262	0.0123
5	TATA STEEL	0.2432	2.8473	0.5070	0.0126
6	ONGC	0.1846	3.3522	0.4120	0.0161
7	INFY	0.1939	4.0696	2.2500	0.1276
8	HDFC	0.229	4.8072	2.5873	0.2604
9	SBILIFE	0.2906	5.2819	0.7690	0.1687
10	ASIANPAINT	0.1872	5.5331	1.9175	0.1928
11	M&M	0.0741	0.8449	1.9001	0.2343
12	POWERGRID	0.0383	0.8832	2.9901	0.2569
13	ULTRACEMCO	0.0217	0.9049	2.7525	0.0020

14	EICHERMOT	0.0942	1.1550	2.4649	0.0026
15	BPCL	0.0748	1.2298	0.9195	0.0027
16	JSWSTEEL	0.1429	1.3727	2.6133	0.0030
17	HEROMOTOCO	0.0225	1.3952	2.8862	0.0031
18	TITAN	0.1443	2.0184	2.6234	0.0044
19	TATAMOTORS	0.0564	2.4570	2.3045	0.0053
20	UPL	0.0081	2.4651	3.1684	0.0053
21	ICICIBANK	0.0876	2.5527	3.6794	0.0053
22	NTPC	0.0151	2.5678	3.3282	0.0054
23	MARUTI	0.0162	2.5840	4.5608	0.0054
24	APOLLOHOSP	0.0201	2.6041	3.7010	0.0054
25	KOTAKBANK	0.1262	2.9735	2.6781	0.0061
26	LT	0.0047	2.9782	3.1023	0.0061
27	HINDUNILVR	0.019	2.9972	2.5296	0.0061
28	DRREDDY	0.0629	3.0601	1.6034	0.0062
29	BHARTIARTL	0.1075	3.1676	6.3804	0.0063
30	AXISBANK	0.0198	3.3720	5.6198	0.0066
31	BAJAJFINSV	0.4944	3.8664	5.0177	0.0075
32	RELIANCE	0.0093	3.8757	1.8416	0.0075
33	BAJAJ-AUTO	0.0403	4.1099	5.1684	0.0079
34	COALINDIA	0.0938	4.2037	0.6982	0.0081
35	GRASIM	0.0502	4.2539	9.0304	0.0080
36	INDUSINDBK	0.019	4.2729	2.3681	0.0080
37	HDFCBANK	0.1027	4.3756	1.0055	0.0082
38	NESTLEIND	0.1543	4.5299	2.1511	0.0084
39	HINDALCO	0.0483	4.5782	1.2666	0.0085
40	TATACONSUM	0.0252	4.8324	3.7022	0.0089
41	WIPRO	0.1352	4.9676	1.6735	0.0091
42	HCLTECH	0.0237	4.9913	2.9095	0.0091
43	DIVISLAB	0.064	5.3459	0.5766	0.0097
44	SUNPHARMA	0.0513	5.5844	1.1425	0.0101

45	CIPLA	0.0117	5.5961	1.3991	0.0101
46	HDFCLIFE	0.0732	5.6693	0.7527	0.0102
47	BRITANNIA	0.0218	5.6911	2.8656	0.0102
48	TECHM	0.0044	5.6955	2.6741	0.0102
49	TCS	0.0464	5.7419	0.8114	0.0102
50	BAJFINANCE	0.0438	5.7857	2.2262	0.0103

Source: Computed data

The cut off rate was calculated using Sharpe's Single Index Model, as shown in Table 3. The formula described in the methodology section of the article is used to determine a number of metrics, including excess return, beta, standard deviation, unsystematic risk, and cutoff rate. It is seen that the cut off rate rises continuously from 0.0101 to 0.2569 before falling. The cutoff rate is thus 0.2569, which equals the value. The portfolio does not include the stocks that fall below the cutoff rate. Consequently, during the time period under consideration, the portfolio is built utilizing 10 equities.

Step 4: Construction of Optimal Portfolio

S.No	Company	X Proportion of Investment
1	SBIN	26%
2	ADANI PORTS	10%
3	ITC	6%
4	ADANI ENT	13%
5	TATA STEEL	4%
6	ONGC	7%
7	INFY	11%
8	HDFC	3%
9	SBI LIFE	9%
10	ASIAN PAINT	4%
11	M&M	5%
12	POWER GRID	2%

(Source: Computed Data)

The calculation of the percentage of money to be invested in the securities chosen to be part of the portfolio is shown in Table 4. According to the calculations, State Bank of India must get 26% of the money, followed by Adani Enterprises (13%), Infosys (11%), and Adani Ports (11%), before SBI Life, ONGC, ITC, M&M, TATA

Steel, and POWERGRID. Investors, portfolio managers, and financial institutions should take notice of these outcomes before investing once they are obtained.

Conclusion

Many investors in the COVID 19 period diversified their portfolios in a similar fashion to how Nifty produced investment returns that were competitive with Treasury notes. Portfolio increases rewards while helping to spread risk. Building a portfolio that is optimum is not a simple process. Analyzing return and risk is necessary. In addition, the investor must determine the excess return received for each unit of risk, the market return, the cutoff rate, and the percentage of money to be invested in certain assets. Thus, the purpose of this article is to examine the process and calculations involved in choosing the stocks to form the portfolio and the percentage of money to be invested. For the period of April 2019 to March 2022, the research chose the stocks from the Nifty 50 using Sharpe's Single Index Model. The research showed that the ideal portfolio is made up of 10 equities throughout the study period. The findings are restricted to the research period and may change with other time periods, indices, and models used in the study. Investors may make smart investing choices thanks to this knowledge. For investors and other market players, this information is useful in choosing stocks to build portfolios and increase returns. The IT industry has also been harmed since a number of businesses have reported a decline in sales as a result of the worldwide cutoff on technology investment as a result of the lockdown. Although certain industries are more resistant to the effects of the corona virus than others, those that are not will be able to recover more quickly. Healthcare, finance, telecommunications, and retail, such as grocery, are some of these industries.

Scope of future research

Research on the Indian stock market and its examination of pre and post COVID-19 circumstances has carved out a sizable platform for researchers to carry out more study on the impact of the same on stock prices and on the nation's economy in the coming days. We ask that the study's scope be expanded to include sectors and indices.

References

1. Abtahi, S. M., & Mohammadi, Z. (2021). Selecting the Optimal Portfolio in agricultural Research and Development Projects with Grey Multiple-Criteria Decision-Making Approach. *Agricultural Economics and Development*, 29(1), 177-207.
2. Agrawal, D. K. (2022). An Empirical Study On Socioeconomic Factors Affecting Producer's Participation In Commodity Markets In India. *Journal of Positive School Psychology*, 2896-2906.
3. Bajo Traver, M., & Rodríguez Alfonso, E. (2022). Integrating the carbon footprint into the construction of corporate bond portfolios. *Documentos de Trabajo/Banco de España*, 2226.
4. Basha, M., Singh, A. P., Rafi, M., Rani, M. I., & Sharma, N. M. (2020). Cointegration and Causal relationship between Pharmaceutical sector and Nifty—An empirical Study. *PalArch's Journal of Archaeology of Egypt/Egyptology*, 17(6), 8835-8842.
5. Basha, S. M., & Kethan, M. (2022). Covid-19 Pandemic and the Digital Revolution in Academia and Higher Education: an Empirical Study. *Eduvest-Journal of Universal Studies*, 2(8), 1-648.
6. Basha, S. M., & Ramaratnam, M. S. (2017). Construction of an Optimal Portfolio Using Sharpe's Single Index Model: A Study on Nifty Midcap 150 Scrips. *Indian Journal of Research in Capital Markets*, 4(4), 25-41.
7. Basha, S. M., Kethan, M., & Aisha, M. A. (2021). A Study on Digital Marketing Tools amongst the Marketing Professionals in Bangalore City. *JAC: A Journal of Composition Theory*, 14(9), 17-23.
8. Bauder, D., Bodnar, T., Parolya, N., & Schmid, W. (2021). Bayesian mean-variance analysis: optimal portfolio selection under parameter uncertainty. *Quantitative Finance*, 21(2), 221-242.
9. Benedetti, D., Biffis, E., Chatzimichalakis, F., Fedele, L. L., & Simm, I. (2021). Climate change investment risk: Optimal portfolio construction ahead of the transition to a lower-carbon economy. *Annals of Operations Research*, 299, 847-871.
10. DrSanthosh Kumar, V., & Basha, S. M. (2022). A study of Emotional Intelligence and Quality of Life among Doctors in PandemicCovid 19. *International Journal of Early Childhood*, 14(02), 2080-2090.
11. JagadeeshBabu, M. K., SaurabhSrivastava, S. M., & AditiPriya Singh, M. B. S. (2020). Influence of social media marketing on buying behavior of millennial towards smart phones in bangalore city. *PalArch's Journal of Archaeology of Egypt/Egyptology*, 17(9), 4474-4485.
12. Kethan, M. (2022). Impact of Task Performance on Job Satisfaction of Information Technology Employees in Bengaluru City.

13. Kethan, M., & Basha, M. (2022). Relationship of Ethical Sales Behaviour with Customer Loyalty, Trust and Commitment: A Study with Special Reference to Retail Store in Mysore City. *East Asian Journal of Multidisciplinary Research*, 1(7), 1365-1376.
14. Kethan, M., Khizerulla, M., Sekhar, S. C., & Basha, M. (2022). A study on issues and challenges on production of handloom sector with special reference to rayalaseema and costal region of Andhra Pradesh. *IJAR*, 8(6), 89-95.
15. Krishnamoorthy, D. N., & Mahabub Basha, S. (2022). An empirical study on construction portfolio with reference to BSE. *Int J Finance Manage Econ*, 5(1), 110-114.
16. Kumarai, G. S., Bajaj, P. K., Rana, S. S., Basha, M., & Karumuri, V. (2022). An empirical study on customer satisfaction towards organized Retail outlets in Bengaluru city, Karnataka. *Academy of Marketing Studies Journal*, 26(5).
17. Mary, J. F., & Rathika, G. (2015). The single index model and the construction of optimal portfolio with cnxpharma scrip. *International Journal of Management*, 6(1), 87-96.
18. Mohammed, B. Z., Kumar, P. M., Thilaga, S., & Basha, M. (2022). An Empirical Study On Customer Experience And Customer Engagement Towards Electric Bikes With Reference To Bangalore City. *Journal of Positive School Psychology*, 4591-4597.
19. Nalini, R. (2014). Optimal portfolio construction using Sharpe's single index model-a study of selected stocks from BSE. *International Journal of Advanced Research in Management and Social Sciences*, 3(12), 72-93.
20. Oyenubi, A. (2020). Optimal portfolios on mean-diversification efficient frontiers. In *Advanced Studies of Financial Technologies and Cryptocurrency Markets* (pp. 35-63). Singapore: Springer Singapore.
21. Setyo, T. A., Asianto, A., & Kurniasih, A. (2020). CONSTRUCTION OF OPTIMAL PORTFOLIO JAKARTA ISLAMIC STOCKS USING SINGLE INDEX MODEL TO STOCKS INVESTMENT DECISION MAKING. *Dinasti International Journal of Digital Business Management*, 2(1), 167-181.
22. Shaik, M. B., Kethan, M., & Jaggaiah, T. (2022). Financial Literacy and Investment Behaviour of IT Professional With Reference To Bangalore City. *Ilomata International Journal of Management*, 3(3), 353-362.
23. Shaik, M. B., Kethan, M., Jaggaiah, T., & Khizerulla, M. (2022). Financial Literacy and Investment Behaviour of IT Professional in India. *East Asian Journal of Multidisciplinary Research*, 1(5), 777-788.
24. Shaik, M. B., Kethan, M., Rani, I., Mahesh, U., Harsha, C. S., Navya, M. K., & Sravani, D. (2022). Which determinants matter for capital structure? an empirical study on NBFC'S in India. *International Journal of Entrepreneurship*, 26, 1-9.
25. Singh, S., & Gautam, J. (2014). The single index model & the construction of optimal portfolio: A case of banks listed on NSE India. *Risk Governance and Control: Financial Market and Institutions*, 4(2), 110-115.
26. Sun, H., Liang, Y., Wang, Y., Liu, X., & Chen, J. (2021). An optimal investment portfolio for BOT freeway projects from the perspective of transportation and construction enterprises. *KSCE Journal of Civil Engineering*, 25(10), 3636-3649.
27. Wang, J., Zhang, H., & Luo, H. (2022). Research on the construction of stock portfolios based on multiobjective water cycle algorithm and KMV algorithm. *Applied Soft Computing*, 115, 108186.