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Portfolio construction and portfolio evaluation using sharpe's model

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Abstract
In the contemporary financial landscape, investment decisions are governed by informed and strategic analysis. One of the most crucial components in personal and institutional finance is portfolio management. Investors aim to construct a portfolio that not only yields the highest return but does so at an acceptable level of risk. Portfolio construction and evaluation, therefore, form the cornerstone of financial decision-making. This project delves into the theoretical and practical aspects of portfolio management using the Sharpe Ratio as the primary tool for performance evaluation.

Portfolio construction involves the identification, selection, and allocation of assets in a manner that aligns with the investor's financial goals, risk appetite, and investment horizon. The Sharpe Ratio, developed by William F. Sharpe, measures the performance of an investment compared to a risk-free asset, after adjusting for its risk. It is defined as the average return earned in excess of the risk-free rate per unit of volatility or total risk. This ratio is instrumental in comparing the risk-adjusted performance of different portfolios and identifying the most efficient allocation of assets.

Formula of the Sharpe's ratio used for the study:

$$S_i = \frac{(\overline{r_p} - \overline{r_f})}{\sigma_p}$$

With:
S_i: Sharpe's measure
r_p: Return of the fund
r_f: Risk-free rate
σ_p: Standard deviation of the fund

This study focuses on the construction and evaluation of a diversified investment portfolio composed of ten NSE-listed companies. The study examines the relationship between the risk and return profiles of these companies and their performance over a 10-year period. By using the Sharpe Ratio, this study aims to provide insights into the risk-adjusted returns of the portfolio and the individual companies.

Research Design
The research design of this study is analytical in nature. It involves the collection, computation,

and interpretation of quantitative financial data to evaluate the performance of a constructed investment portfolio. The study is primarily focused on secondary data analysis and employs financial metrics, particularly the Sharpe Ratio, to assess the risk-adjusted returns of selected securities and the overall portfolio.

Tools and Techniques Used

The key analytical tool employed in this research is the Sharpe Ratio. Supporting statistical measures such as mean, standard deviation, and variance are also used to compute return and risk. The Sharpe Ratio helps assess how well each stock and the portfolio as a whole compensate investors for the risk taken relative to the risk-free rate.

Data Analysis Process

1. Calculation of annual returns for individual stocks.
2. Computation of average return and standard deviation over the 10-year period.
3. Determination of the Sharpe Ratio for each stock and the portfolio.
4. Comparative analysis between individual stock Sharpe Ratios and the overall portfolio Sharpe Ratio.
5. Interpretation of the results in the context of portfolio theory and investment.

Trent (Table 1 Showing Price, Yearly Return, Sales, PAT and EPS of Trent)

Year	Price ₹	Yearly Return %	SALES (₹ Crore)	PAT (₹ Crore)	EPS ₹
2015	1490	18.17	2,284	87.04	3.89
2016	1750.15	-88.71	1,686	94.84	1.66
2017	200.4	64.46	1,812	105.98	2.55
2018	337.15	6.56	2,157	154.58	2.62
2019	362.3	45.5	2,630	249.63	2.92
2020	527.15	30.47	3,486	-51.02	3.46
2021	687.6	54.15	2,593	262.79	-4.11
2022	1065	26.89	4,498	554.57	2.98
2023	1351.35	124.96	8,242	1,435.82	12.51
2024	6954	133	12,375	1,477.46	41.82
CAGR	17%	22%	18%	33%	27%

ITC (Table 2 Showing Price, Yearly Return, Sales, PAT and EPS of ITC)

Year	Price ₹	Yearly Return %	SALES (₹ Crore)	PAT (₹ Crore)	EPS ₹
2015	368.7	-10.83	38,817	9,608	8.04
2016	327.8	-26.24	39,192	9,328	7.74
2017	241.65	8.78	42,768	10,201	8.47
2018	263.25	6.99	43,449	11,223	9.24
2019	281.65	-15.77	48,340	12,464	10.27
2020	237.7	-12.41	49,388	15,136	12.45
2021	209	3.88	49,257	13,032	10.69
2022	218.05	52.05	60,645	15,058	12.37

2023	331.55	39.65	70,919	18,753	15.44
2024	477	4.35	70,866	20,422	16.39
CAGR	3%	-1%	6%	8%	7%

Portfolio Return

Year	Trent	ITC	CG power	Titian	Nesco	Godrej	CDSL	Jtekt	tejas	Tata power	Portfolio return %
2015	18.17	-10.83	3.14	-8.96	-3.95	-	-	7	-	-17.4	**-8.981**
2016	-88.71	-26.24	-69.42	-5.56	14.05	-	-	2.73	-	11.45	**-113.19**
2017	64.46	8.78	-36.02	160.88	-73.12	-5.9	43.04	78.47	53.85	23.19	**31.76**
2018	6.56	6.99	-51.93	8.55	-17.34	-13.52	-37.44	-7.58	-48.14	-18.12	**-17.197**
2019	45.5	-15.77	-76.86	27.5	48.86	2.6	-0.85	-13.08	-54.3	-26.62	**-6.302**
2020	30.47	-12.41	398.33	31.2	-17.42	3.78	138.52	0	43.76	33.19	**64.942**
2021	54.15	3.88	96.04	61.47	6.06	-4.65	178.77	5.15	195.04	190.72	**78.66**
2022	26.89	52.05	37.21	3.49	5.22	-9.65	-25.75	62.31	36.08	-6.1	**18.17**
2023	124.96	39.65	70.19	40.98	43.21	16.87	62.76	4.58	49.63	59.11	**51.19**
2024	133	4.35	58.71	-11.81	8.34	33.47	-3.64	2.01	35.51	17.52	**27.74**
CAGR	170%	30%	150%	240%	60%	60%	360%	110%	210%	170%	

Year-Wise Portfolio Return and Risk-Adjusted Performance (Sharpe Ratio)

Year	Portfolio Return (%)	Sharpe Ratio
2015	-8.98	-0.254
2016	-113.2	-2.26
2017	31.76	0.53
2018	-17.20	-0.41
2019	-6.30	0.12
2020	64.94	1.17
2021	78.66	1.43
2022	18.18	0.27
2023	51.19	0.90
2024	27.75	0.45

The image shows a table listing the returns and rankings of 10 companies

Returns and Rankings

Company	Return (%)	Rank
CDSL	44.43	1
CG Power	42.94	2
Trent	41.55	3

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Tejas	38.93	4
Titan	30.77	5
Tata Power	26.69	6
JTEKT	14.16	7
ITC	5.05	8
Godrej Agrovet	2.88	9
Nesco	1.39	10

Construction of Optimal Portfolio

Portfolio A : Assuming investment of Rs.10,00,000 in five different companies shares like

CDSL, Tejas, Titan, JTEKT, and ITC . In each company Rs.2, 00,000 each were invested.

Company Name	Return %	Invested Amount ₹
CDSL	44.43	2,00,000
Tejas	38.93	2,00,000
Titan	30.77	2,00,000
JTEKT	14.16	2,00,000
ITC	5.05	2,00,000

	Return (%)	Deviation from Mean	SD
CDSL	44.43	17.76	315.42
Tejas	38.93	12.26	150.30
Titan	30.77	4.10	16.81
JTEKT	14.16	-12.51	156.53
ITC	5.05	-21.62	467.47

Step 3: Variance and Standard Deviation

Portfolio B Assuming investment of Rs.10,00,000 in five different companies shares like CG

Power, Trent, Tata Power, Godrej Agrovet, and Nesco

Company Name	Return %	Invested Amount ₹
CG Power	42.94	2,00,000
Trent	41.55	2,00,000
Tata Power	26.69	2,00,000
Godrej Agrovet	2.88	2,00,000
Nesco	1.39	2,00,000

Step 1: Calculate Mean Return

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$$\text{Mean } (\bar{R}) = \frac{42.94 + 41.55 + 26.69 + 2.88 + 1.39}{5} = \frac{115.45}{5} = 23.09\%$$

Step 2: Calculate Squared Deviations from Mean

Company	Return (%)	Deviation from Mean	SD
CG Power	42.94	19.85	393.02
Trent	41.55	18.46	340.96
Tata Power	26.69	3.60	12.96
Godrej Agrovet	2.88	-20.21	408.44
Nesco	1.39	-21.70	470.89

Step 3: Variance and Standard Deviation

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$$\text{Variance} = \frac{393.02 + 340.96 + 12.96 + 408.44 + 470.89}{5} = \frac{1626.27}{5} = 325.25$$

$$\text{Standard Deviation (Risk)} = \sqrt{325.25} = \mathbf{18.04\%}$$

Final Answer:

Portfolio	Mean Return (%)	Risk (Standard Deviation %)
A	26.67	14.88
B	23.09	18.04

The portfolio analysis was conducted by dividing the 10 selected NSE-listed companies into two equal-weighted portfolios of five companies each, with an investment of ₹2 lakhs per company.
Portfolio A, comprising CDSL, Tejas Networks, Titan, JTEKT India, and ITC, achieved an average return of 26.67% with a risk (standard deviation of returns) of 14.88%.
Portfolio B, consisting of CG Power, Trent, Tata Power, Godrej Agrovet, and Nesco, generated an average return of 23.09% with a higher risk of 18.04%.
This indicates that Portfolio A not only outperformed Portfolio B in terms of returns but also exhibited lower volatility, making it a more efficient investment choice during the period analyzed.

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