IME 611 TASK B REPORT
GROUP 9

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No member in our group has done any course on Time Series.

We first use pandas DataReader to get the stock price data for both Nifty 50 and Nifty 100 stocks. We found that many companies in these indices were not listed in the period provided to us, so we dropped them from our initial dataset; there were two such stocks.

We will primarily focus on the Nifty 50 universe for this project. We are also reducing the time period for our studies in some cases due to COVID19, as it had a devastating effect on the market as we know it.

We are asked to initialise the top 15 stocks from the initial 48 stocks which we have considered before by offering the highest Sharpe ratio.

What is Sharpe Ratio?

The difference between the Return of the portfolio and the Risk-free Rate, divided by the standard deviation of the portfolio's excess return is the value of the Sharpe ratio. It helps the investors estimate the return on investment compared to the risk involved.
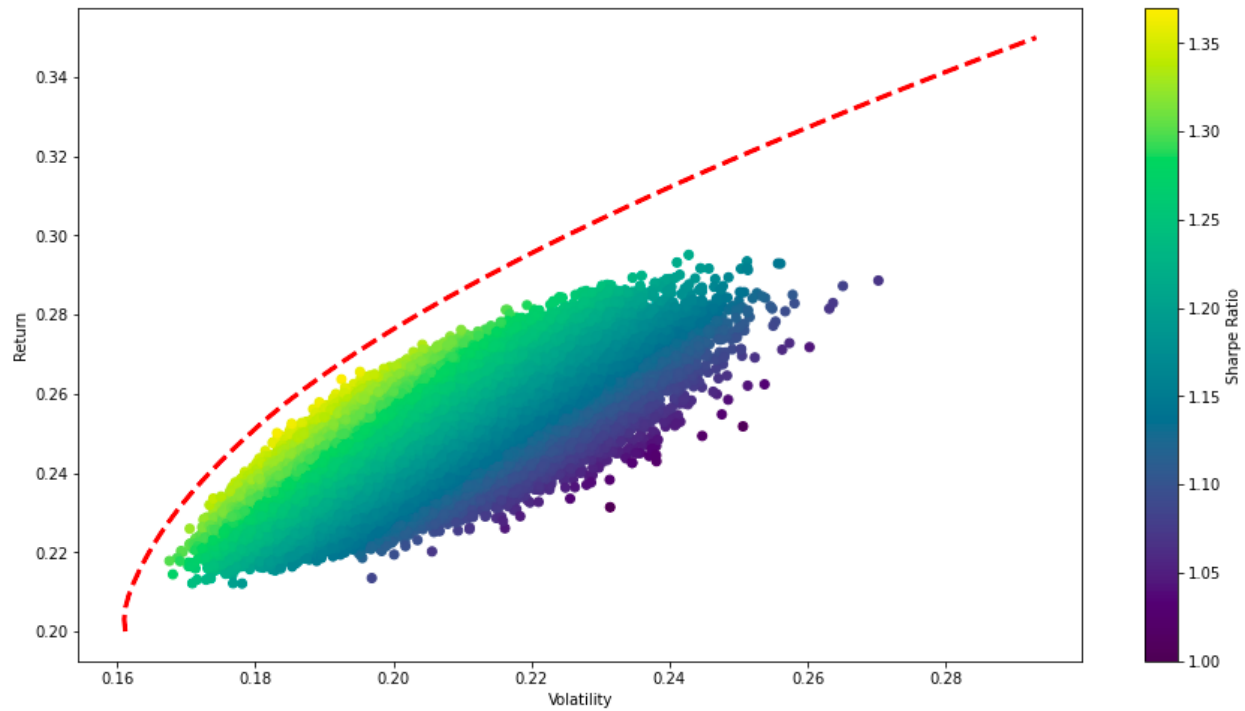
$$\text{Sharpe Ratio} = \frac{R - Rf}{S.D.}$$

Generally the higher the Sharpe Ratio, the better risk-adjusted returns are expected, thus to make our portfolio on Moneybhai we took the best 15 stocks according to the analysis and Sharpe Ratio performed in Task A.

Task 1

For these top 15 stocks, the weights to be given to each one of them was calculated by using the Markowitz portfolio approach along with the efficient frontier. In this task, we have taken 15 stocks whose Sharpe ratio is highest among the 48 stocks initially
considered.

Efficient frontier for top 15 stocks

The **maximum Sharpe ratio** for this **complete portfolio** is: _**1.37**_
Now according to the weights assigned we divided the amount available for investment (1 cr) among each stock and calculated the number of stocks for each of them. After this, we placed this order on Moneybhai and waited for the end date.

S.No	Stock Name	Sharpe Ratio	Weights	Number of stocks
1	ADANIPORTS.NS	0.24786	0.00468	54
2	BRITANNIA.NS	0.21323	0.00131	4
3	TCS.NS	0.31742	0.12322	374
4	HINDALCO.NS	0.22264	0.00758	216
5	HINDUNILVR.NS	0.27713	0.13596	565
6	TATASTEEL.NS	0.37962	0.02083	249

7	JSWSTEEL.NS	0.25169	0.11262	2096
8	DIVISLAB.NS	0.23433	0.07012	188
9	NESTLEIND.NS	0.23589	0.11139	62
10	ASIANPAINT.NS	0.20823	0.17632	67
11	TITAN.NS	0.32991	0.13393	869
12	BAJAJFINSV.NS	0.35656	0.27020	28
13	RELIANCE.NS	0.30351	0.11301	563
14	BAJFINANCE.NS	0.50520	0.11601	232
15	HDFCBANK.NS	0.20826	0.00469	32

Task 2

We have traded on the platform from **7-4-2021 to 8-5-2021** with these above 15 stocks and their assigned number.

RETURNS

Returns are primarily the quantity of cash earned or lost by the worth of a portfolio. Returns are expressed as a share of total portfolio price, that is, the quantitative relation of gain (or loss) to total portfolio price.

VOLATILITY

Volatility is frequently estimated as either the standard deviation or difference between gets back from that equivalent security or market index. Volatility is a marker of how frequently a portfolio's ordinary returns change. The higher the instability, the more dangerous the security.

SHARPE RATIO

The difference between the Return of the portfolio and the Risk-free Rate, divided by the standard deviation of the portfolio's excess return is the value of the Sharpe ratio. It helps the investors estimate the return on investment compared to the risk involved.

$$\text{Sharpe Ratio} = \frac{R - Rf}{S.D.}$$

SORTINO RATIO

The Sortino ratio is a variation of the Sharpe proportion that utilizes the resource's standard deviation of negative portfolio returns (downside deviation) as opposed to the absolute standard deviation of portfolio returns to recognize harmful volatility from total overall volatility. The Sortino proportion is determined by deducting the risk-free rate from the return of a resource or portfolio, at that point dividing the outcome by the resource's downside deviation.

MAXIMUM DRAWDOWN

A maximum drawdown (MDD) is the greatest noticed misfortune from a top to a box of a portfolio, before another pinnacle is achieved. The most extreme drawdown is a marker of disadvantage hazard throughout a predefined time frame.

CALMAR RATIO

The Calmar ratio is a check of the presentation of speculation assets, for example, hedge fund investments and commodity trading advisors (CTAs). It is a component of the asset's average compounded yearly rate of return versus its maximum drawdown. The higher the Calmar ratio, the better it performed on a risk changed premise during the given time span.

	Return	Volatility	Sharpe R	Sortino R	Calmar R	Max DD
Week 1 (MarketIndex)	-1.358 %	4.519 %	-	-	-	-
Week 1 (Portfolio)	0.323 %	4.407 %	0.037	No -ive change	0.108	2.982 %
Week 2 (MarketIndex)	-3.224 %	4.685 %	-	-	-	-

Week 2 (Portfolio)	-1.833 %	4.442%	-0.478	-0.536	-0.462	3.967 %
Week 3 (MarketIndex)	-1.268 %	5.503 %	-	-	-	-
Week 3 (Portfolio)	3.426 %	5.600 %	0.540	0.728	0.864	3.967 %
Overall/Week 5 (MarketIndex)	0.027 %	5.676 %	-	-	-	-
Overall/Week 5 (Portfolio)	5.061 %	5.645 %	0.811	1.023	1.276	3.967 %

Beta of Portfolio: 0.87
The beta of the portfolio helps us determine the risk of the portfolio when compared to the market as a whole (in terms of benchmarks).
A portfolio with a beta of 0.87 has experienced gains and losses that are 87% of the benchmark's changes.

Alpha of Portfolio in %: 4.19 %
A positive value of alpha implies that the portfolio has outperformed the index. It can be thought of as excess return when compared with the benchmark. So an alpha of 4.19% means that the portfolio has outperformed its benchmark by 4.19%.

Task 3

After selecting the best 15 stocks based on their Sharpe ratio in descending order, we calculated the weights for the optimised portfolio in order to maximise the Sharpe ratio of the complete portfolio. The **Sharpe ratio** of the designed portfolio is **0.811,** which is positive and near about 1 thus is acceptable as the risk-free rate is lesser than the portfolio's return, or the portfolio's return is expected to be positive.
The alpha and beta values of the portfolios, 4.19% and 0.87 support the fact that the optimised portfolio can potentially perform better.

After trading on the platform the returns observed are as follows:
Return of _**Market Index: 0.027 %**_
Return of _**Portfolio: 5.061 %**_

Volatility for both Market Index and Portfolio was approximately the same **~5.6%**

When comparing the returns of the benchmark/market index with the portfolio, we observe a significant difference in the returns which can be supported by the argument that we have optimised the portfolio using Markowitz portfolio theory. Although both market index and portfolio incur similar volatility yet returns are better because the portfolio is adjusted such that it tends to outperform the market index.
One more observation can be made from the above table, the jump in week 3 when compared to week 2 is expected because of the second COVID wave. In every case, a keynote to be observed is that the portfolio outshines the market index returns due to the optimisation carried out in the complete project.

To conclude the project, we would like to infer that although Markowitz Portfolio Theory has let us see some positive results, yet there are certain limitations associated with it:

- Large data and heavy computation in order to calculate returns, the variance of each security and correlation between all pair of securities is required
- All the investors are risk-averse and expect maximum return

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