PORTFOLIO CREATION USING MARKOWITZ MODEL ON TOP-FIVE IT COMPANIES IN INDIA

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Abstract:
This research paper aims to understand how the Portfolio's creation using the Markowitz Model will help choose the best Portfolio among the number of available portfolios if an investor is investing in two companies. This paper will help all investors who want to invest in companies that make maximum profit for an equal amount of Risk instead of investing in random companies. The data included in this research is from secondary data collected from financeyahoo.com as a source of data for analyzing best portfolios, which will be helpful for an investor to invest in these companies, specifically IT sectors. The findings of this research paper are to make an investment in the best Portfolios than making investments from random two companies. In this, there are ten portfolios' out of which there are five Portfolios those are the best portfolios for an investor to make investments in such companies, remaining there are only in the proportion of 70: 30, 80: 20, 90: 10 and 100: 0 which

are not suitable to invest as per my opinion. This research paper is only limited to those investors who want to invest in two companies. Future researchers can concentrate on making portfolios of more than three companies and try to link with other more profitable sectors and create an investor easy to make the investment that brings maximum returns and minimizes the Risk.

Keywords*: Markowitz model, Investment Portfolios, Covid-19, Portfolio Evaluation and Portfolio Selection, IT Sectors*

INTRODUCTION:

"As a consequence of Covid-19 and later, IT has become the most visible internal function, with business and other functions expecting IT services and support like never before. In the post-COVID-19 era, IT will truly become the backbone of the business." IT sectors are growing day by day during and post pandemics, and their contribution to the GDP is also improving day by day. So, investors may think they have to invest in which sector and which sector's performance is better during the pandemic. So, the answer to all these questions is here; According to Gartner, as information provided by **(Business Standard 2021)**, IT spending in India is expected to increase up to US$ 93 billion in 2021 (7.3 per cent year on year growth) and US$ 98.5 billion in 2022.. Investments can be made in various assets, including real estate and financial support.

Investment in financial assets is much more liquid or yields a faster return. Because the value of financial assets fluctuates significantly, liquidity exists. The value of assets can change quickly, encouraging investors to invest. So, while selecting the best portfolios, the investors can choose the portfolios based on the Markowitz Model. They are analyzing various potential portfolios of the given securities aids in choosing the most efficient Portfolio. Since investors behave rationally to minimize Risk and maximize Portfolio, the Markowitz Model is best for selecting an optimal portfolio. The benefit for the investors of using this model is that an investor can construct a portfolio of multiple assets that will yield higher returns while reducing the Risk where investors will look for diversified portfolios. So in this, I'm choosing the Top 5 companies in the IT sector to see the different combinations of portfolios, which

would help the investors to make the best choice and make a better decision in choosing the best Portfolio.

All over the world as of today, India is the leader in Information Technology; it's not just for one or two stocks, but many top-class companies in the category. This sector has not just contributed to India's growth journey but also became multi-bagger stocks (Multibaggers are stocks that provide returns that are multiples of their costs), and not only that, it has also offered high-quality jobs in India and the standard of living of middle-class people has raised in India. In future also, IT sectors will continue to grow and create enormous opportunities in India.

After analyzing the company's Profitability, Economic growth, Financial Position the company, and Recent trends or the technologies adopted by these IT companies, investors' investment decisions will be based on the best available Portfolio. Because a rational investor doesn't just look into these things, his investment decision finally depends on the best Portfolio. So, the Markowitz Model plays an essential role in decision making because an investor wants more returns and low Risk or with a more amount of Risk; more returns after considering all the above factors. So, in this Top 5 Companies, investors will search for opportunities available under this Portfolio and chooses the best Portfolio for their decision making where his complete process for investing will end here where a rational investor will not make his decision based on Individual Company as Putting all the eggs in one basket and incurring loss is not a decision of the sensible investor.

OBJECTIVES OF THE STUDY:

1. To estimate and analyze the portfolio return of various portfolios designed for the combination of companies from IT sectors and their relationship to other stocks in the Portfolio.
2. To investigate the optimization of Investment portfolios by using Markowitz Model.

REVIEW OF LITERATURE:

The literature review is all about findings from different authors about the Portfolio of other sectors, same sectors or Top 10 companies from all the sectors, which results in the relationship between Risk and Return.

(Fadadu, Mathukiya, & Parmar, 2015). (Danko & Soltes, 2018) The study stipulates that the share market in India supports the efficient market theory, though the market responds quickly. To construct an efficient Portfolio, it's required to minimize the risk level. With the help of beta, we can easily calculate the systematic Risk. Total portfolio risk is reduced by mitigating systematic Risk with asset allocation and unsystematic Risk with diversification. With the help of both risk management solutions such as asset allocation, diversification and Valuation timing.**(Danko, Soltes, & Bindzár, New Approach to Portfolio Creation Using the Minimum Spanning Tree Theory and Its Robust Evaluation, 2020)** has found that their proposed method provides (on average) the best appreciation of the invested resources while also being the least risky investment in terms of relative variability, which is very appealing from the perspective of an individual investor where **(Abdul Hali & Yuliati, 2020) and (Shadabfar & Cheng, 2020).** The portfolio optimization discussed takes tolerance for Risk into account. An equation form has been obtained to get the weight of the fund allocation for each asset in the investment portfolio **(Aqilah Mohammed Fauzi et al., 2019)** which helps in the decision making of an investor with the help of the TOPOSIS model for analyzing Top 5 companies and Markowitz model for identifying best Portfolio. Markowitz portfolio optimization model, the researchers have found that the estimated Risk is closer to the realized Risk when the filtering procedures are used in general. But in another bootstrap analysis, the ratio between the recognized Risk and the expected Return is improved. Overall, the research has shown that different filtering procedures give different portfolio optimization results. All of it depends on the various risk level of the Portfolio, the period size of the investment, the reliability of the Risk, and the return estimation **(London, Gera, Banhelya 2018)**. There were two findings in this research as stated by **(Širůček & Křen, 2015):** The relationship was not as prominent between the expected rate of return and the beta coefficient and was not clear as Sharpe and Lintner expected. The high beta coefficient does not guarantee higher returns, as even

other indicators should be taken into account like capitalization of the market or the ratio of book value to the market value of stocks(B/M) as indicated by the Fama and French(2004) or P/E ratio Indicated by Sirucek, Soba and Nemecek(2014). Overall, the beta coefficient was not sufficient To identify or explain the expected returns. The Markowitz model is best for portfolio selection. It will reduce the Risk for Indian Investors, increase the returns for the selected Portfolio, and provide alternatives for investors in choosing the Portfolio **(Joshi, 2020) and (Muslim, 2020).** Used properly, a manager can increase portfolio returns and reduce Risk to optimize an investment portfolio **(Fadadu, Mathukiya, & Parmar, 2015). (Danko & Soltes, 2018), (Šoltés & Danko, 2017)** there is no dependence between minimized standard deviation from the perspective of the prize history of the portfolio and Simulations stocks on the periphery of the estimated minimum spanning trees have a higher diversification potential than others. A portfolio with more significant diversification potential has a lower average value of the minimized standard deviation created by simulation of a specific sample (small vs large eccentricity).

According to **(Prastiwi, Kartowagiran, Susantini 2020),** in this study, there were four stages of developing the electronic Portfolio. As per the study, there were several advantages to using an electronic Portfolio as an assessment. It is found that an electronic Portfolio facilitates lifelong learning as it has helped capture, manage, and examine the students' learning experience. The lecturers and students can also communicate better by communicating the actual concepts or information. Students can also use audio and videos and make the portfolios more interesting. The study has computed the critical diffusion coefficient in the case of multidimensional discrete law and Gaussian law, and the researchers have provided a solution to the problem in the multidimensional case. The researchers have explained a way for measuring the working and performance of investment strategies, the Sharpe ratio of terminal wealth and used this to assess the value of investments **(de Franco, Pham, Nicolle 2019).**

RESEARCH METHODOLOGY:

This includes qualitative and quantitative research as I'm using the Markowitz model to optimize portfolios, and it is purely secondary data and empirical in nature. To analyze the Return and the Risk of portfolios, I have considered sample units of 2019,

2020 and 9 months of 2021 data of Top 5 IT Companies of TCS, Infosys, HCL Technologies, Wipro and Tech Mahindra from **financeyahoo.com** as it is a timespan data and I will be exploring the Correlation of these portfolios to see how the investor invests in these companies that signifies the degree of relationship between the price movements of the various Portfolio's assets.

DATA ANALYSIS:

In this study, the data analysis will begin by introducing the Top 5 IT companies in India. This has been chosen by analyzing the Profitability and Valuation of the company. So Top 5 companies have been selected from one of the articles which give a detailed brief about the Profitability and Valuation of the company. So, I have chosen the Top 5 IT companies from that article for my study.

So, the Top 5 IT Companies in India are

1. Tata Consultancy Services (TCS)
2. Infosys
3. Hindustan Computer Limited (HCL)
4. Wipro
5. Tech Mahindra

PROFITABILITY RATIO:

It represents the profit portion of total income generated after subtracting the costs of goods sold. In this particular ratio, there are various other kinds of ratios. So, for choosing the best Portfolio, Investors will look into Return on Equity (ROE) and Return on Capital Employed (ROCE). So we will see one by one for each company.

Return on Equity (ROE): Return on equity assesses how often a company earns for every dollar invested. When it comes to ROE, TCS is consistently at the top, with consistently higher ROE. Its most recent ROE is 47.99%, and it is followed by Infosys, which has a most recent ROE of 29.34%. Then there's HCL, with an ROE of 21.80% and Wipro, with an ROE of 19.66%. Finally, Tech Mahindra has an ROE of 17.81% Wipro was consistently lower than HCL until FY 21, but Wipro has surpassed HCL in ROE in the most recent numbers. So, in terms of ROE, TCS is number one, Infosys is number two, HCL is number three, Wipro is number fourth and finally,

Tech Mahindra is last even though Tech Mahindra and Wipro are close with a difference of 2%.

Return on Capital Employed (ROCE): ROCE will measure the profitability and efficiency of the company as it assesses how it is generating its profits by making use of capital that is put into use. When it comes to ROCE, TCS is once again at the top, with a consistently high ROCE of 52.91%. It is followed by Infosys, which has the most recent ROCE of 35.96%. Then there's HCL, which has 30.14%. Wipro has 27.32% and finally, Tech Mahindra has 20.39%. So, in terms of ROCE, TCS is ranked. First, Infosys is ranked second, HCL is ranked third, Wipro is ranked fourth and Tech Mahindra is ranked fifth. However, all five companies are incredibly profitable.

Shareholdings of the company: Shareholders are the one who plays significant roles in the company's direct as well as indirect operation of a company. So now we will look into the shareholders of each IT sector. Shareholdings of TCS promoters own 72.19% of the company; later comes Infosys, where promoters own 12.95% of the company. Then will see the promoter's shareholding in HCL where advocates hold 60.33%, followed by Wipro promoters having 73% of the company, and finally, the proponents of Tech Mahindra hold 35.76% of the company. In terms of Shareholdings, Wipro holds the first position, followed by TCS, then HCL, after HCL Tech Mahindra and finally Infosys. So, except for Infosys, all companies have a high percentage of promoter shareholding.

VALUATION OF THE COMPANY:

The method of evaluating a business's current worth and economic value using objective measures and evaluating all aspects of the company is known as business valuation. Valuation is based on the Price to Earnings Ratio (PE Ratio).

Price To Earnings Ratio (PE Ratio): PE ratio is a valuation method. It refers to comparing a company's current share price to its earnings per share (EPS) of a company. TCS is currently trading at Rs 3546.70 at a PE ratio of 33.87, Infosys at Rs 1567.55 at a PE of 29.82, HCL at Rs 1079.25 at a PE of 21.70, Wipro at Rs 508.80 at

a PE of 23.02, and Tech Mahindra at Rs 1259.00 at a PE of 23.80. From the perspective of Valuation, we can rank TCS first. It is followed by Infosys in second place, Tech Mahindra in third place, Wipro in fourth place, and HCL Technologies in fifth place. Overall, we can conclude that all five companies are excellent in the business, have the necessary skill set, and have a future growth plan. Nowadays investors will be willing to pay higher share prices because more expectations of growth in future may lead to more returns.

Following is the table which shows overall important ratios of the Top IT companies in the form of a table to make it easy for the people who want to invest in these companies:

Table 1: Company Financial

COMPANY NAME	ROE	ROCE	PE RATIO	SHARE HOLDINGS	PRICE OF SHARES
TCS	42.99%	52.91%	33.87	72.19%	3546.70
INFOSYS	29.34%	35.96%	29.82	12.95%	1567.55
HCL	21.80%	30.14%	21.70	60.33%	1079.25
WIPRO	19.66%	27.32%	23.02	73%	508.80
TECH MAHINDRA	17.81%	20.39%	23.80	35.76%	1259.00

MARKOWITZ MODEL:

In 1952, Dr Harry M Markowitz proposed this model. It aids in selecting the most efficient by analyzing different possible portfolios of the given securities. The HM model demonstrates how to reduce Risk by selecting securities that do not 'exactly together. The HM model is also known as the Mean-Variance Model because it is

based on the various portfolios' expected returns (mean) and standard deviation (variance).

Now I will determine the Expected Return and Risk for a set of efficient portfolios and then will analyze the results and select the best Portfolio from the collection of efficient portfolios that yields maximum Return and minimum Risk or the portfolios with the same level of Risk expected return.

I have analyzed companies, and ten portfolios have been found for IT sectors. The portfolio includes TCS & INFOSYS, TCS & HCL TECHNOLOGIES, TCS & WIPRO, TCS & TECH MAHINDRA, INFOSYS & HCL TECHNOLOGIES, INFOSYS & WIPRO, INFOSYS & TECH MAHINDRA, HCL & WIPRO, HCL & TECH MAHINDRA and WIPRO & TECH MAHINDRA. The ten portfolios are as follows:

1. TCS AND INFOSYS
2. TCS AND HCL TECHNOLOGIES
3. TCS AND WIPRO
4. TCS AND TECH MAHINDRA
5. INFOSYS AND HCL TECHNOLOGIES
6. INFOSYS AND WIPRO
7. INFOSYS AND TECH MAHINDRA
8. HCL TECHNOLOGIES AND WIPRO
9. HCL TECHNOLOGIES AND TECH MAHINDRA
10. WIPRO AND TECH MAHINDRA

Table 2: Returns of all IT companies:

Date	**TCS returns**	**info returns**	**HCL returns**	**Wipro returns**	**tech mah returns**
2019-01-01					
2019-02-01	-1.51	-2.09	4.78	0.189545581	13.53
2019-03-01	0.81	1.14	3.30	-8.198218378	-6.71
2019-04-01	12.72	1.03	8.76	17.13444318	7.54
2019-05-01	-2.58	-1.75	-7.59	-3.971181715	-8.90

2019-06-01	1.38	-0.66	-2.65	-2.146220296	-7.12
2019-07-01	-0.98	8.48	-2.81	-5.367328218	-9.87
2019-08-01	2.39	2.59	6.35	-4.145468156	9.28
2019-09-01	-7.03	-1.14	-1.80	-5.720464972	2.68
2019-10-01	8.15	-14.88	7.67	8.090078714	3.44
2019-11-01	-9.58	1.52	-3.07	-8.294758489	3.07
2019-12-01	5.29	5.14	0.79	3.470761508	0.14
2020-01-01	-3.79	6.09	4.09	-3.720265953	4.30
2020-02-01	-3.77	-5.80	-9.70	-6.630066217	-6.47
2020-03-01	-8.89	-12.45	-18.23	-11.08095854	-24.06
2020-04-01	10.52	1185	24.28	-3.102749651	-3.34
2020-05-01	-2.15	-3.47	1.40	11.57480472	-2.87
2020-06-01	5.61	6.44	1.07	3.363911503	2.46
2020-07-01	9.62	31.30	26.81	27.71962214	25.49
2020-08-01	-1.14	-3.91	-1.72	-3.278692731	8.68
2020-09-01	10.42	8.56	17.06	15.54900992	6.81
2020-10-01	6.96	5.22	3.89	8.625633764	2.78
2020-11-01	0.54	3.77	-2.49	2.891532709	7.67
2020-12-01	7.13	14.11	15.05	10.19971469	11.06
2021-01-01	8.46	-1.29	-3.28	8.233006602	-1.17
2021-02-01	-6.97	1.02	-0.60	-1.87776013	-4.48
2021-03-01	9.72	9.21	8.14	0.9751340524	7.91
2021-04-01	-4.38	-1.01	-8.54	18.87976334	-2.98
2021-05-01	3.97	2.94	5.08	9.443548044	6.25
2021-06-01	5.90	13.46	4.15	1.252551438	7.17
2021-07-01	-5.31	1.83	4.17	7.504801649	10.44
2021-08-01	19.54	5.83	15.21	9.316404063	19.67
2021-09-01	-0.32	-1.69	8.26	-1.076027135	-4.58
2021-10-01	-4.32	2.39	-2.20	11.53937334	3.57

Table 3: Expected return and risk for all it sectors:

Company Name	Expected Return	Risk
TCS	24.15	24.12
INFOSYS	34.12	28.24
HCL TECHNOLOGIES	38.41	32.22
WIPRO	39.03	31.21
TECH MAHINDRA	29.60	32.20

We can observe in the above chart, all the IT Companies except Tech Mahindra have the Expected Return good expected returns and for TCS, the Expected Return and the Risk are the same. The rest of the companies have more expected Returns than Risk, but the decision cannot be made based on these results. But in the case of Tech Mahindra, Risk is more than the Expected Return. So to know best, the Portfolio will analyze the Correlation between two companies for each Portfolio and continue with another process of evaluating the results.

From the above table, we can recognize the correlations for each Portfolio. The Correlation will act as compensation for an investor between increased Risk and potentially higher returns. According to Markowitz, if the coefficient correlation is +1, then it is a perfect positive correlation when it is -1. It is a perfect negative correlation, and one more suggestion given by him is whichever is having -1 then the Return of a portfolio will be minimum and securities which will have a lower than positive Correlation, there will be a low risk without reducing the returns to come down that means there won't be much profit. Still, returns won't reduce it, maybe the same or slightly increase. From the table above, TCS and Infosys, Infosys and Wipro and HCL Technologies and Wipro have a low positive correlation. Rest other portfolios have more than 0.5, which means that portfolios with these securities will be moving up and down. But a rational investor will always check the Optimum Portfolio from the number of available portfolios, resulting in the best portfolios to invest in and have good returns.

Table 4: Correlation for each Portfolio:

SL.NO	Portfolios	Correlation
1	TCS AND INFOSYS	0.44
2	TCS AND HCL TECHNOLOGIES	0.71
3	TCS AND WIPRO	0.51
4	TCS AND TECH MAHINDRA	0.50
5	INFOSYS AND HCL TECHNOLOGIES	0.68
6	INFOSYS AND TECH MAHINDRA	0.56
7	INFOSYS AND WIPRO	0.42
8	HCL TECHNOLOGIES AND WIPRO	0.49
9	HCL TECHNOLOGIES AND TECH MAHINDRA	0.68
10	WIPRO AND TECH MAHINDRA	0.57

OPTIMAL PORTFOLIO:

In this, I will find out the Portfolio Risk and Portfolio Return for each Portfolio and then Sharpe's Ratio. Risk of the portfolio is the possibility that the combination of assets or units in your investments will fail to meet financial objectives. In contrast, Portfolio Return is the gain or loss realized by an investment portfolio of various assets. The Sharpe Ratio defines an excess risk in a portfolio's past performance and expected future performance.

Table 5: Construction of portfolio by changing the percentages of money invested in both the stocks

Construction of 11 portfolios by changing % of the money invested in both the stocks for TCS and INFOSYS					
Portfolio	**Weight-TCS**	**Weight-INFO**	**Portfolio-Risk**	**Portfolio-Return**	**Sharpe Ratio**
1	1	0	24.12	24.15	0.9968516933
2	0.86	0.14	22.77	25.54	1.117418222

3	0.76	0.24	22.18	26.54	1.192279597
4	0.66	0.34	21.92	27.94	1.269772564
5	0.53	0.47	22.12	28.83	1.298740873
6	0.42	0.58	22.75	29.93	1.311349069
7	0.38	0.62	23.07	30.33	1.310223609
8	0.26	0.74	24.33	31.53	1.291841328
9	0.16	0.84	25.66	32.52	1.26356054
10	0.06	0.94	27.22	33.52	1.228005968
11	0	1	28.24	34.12	1.204653824

From the above table, we can find different portfolios, but the most important thing we have to look into is an Optimal Portfolio. In the 6th row, we can see the optimal Portfolio because of the high Sharpe Ratio. So, the best option for an investor is to invest 42% in TCS, and 58% in Infosys and the Sharpe Ratio is 1.311349069. So, Risk is equal to return where Risk is 22.75 and Return is 29.93. And the Correlation also shows a more significant relationship between TCS and Infosys: r = 0.44. As per Markowitz, having less than 50%, there will be a more significant correlation between these portfolios, where an investor will not incur loss and more Risk.

Table 6: Construction of 10 portfolios by changing % of the money invested in both the stocks of TCS and HCL TECHNOLOGIES

Portfolio	Weight-TCS	Weight-HCL TECH	Portfolio-Risk	Portfolio-Return	Sharpe Ratio.
1	1	0	24.12	24.15	0.9968516933
2	0.9	0.1	24.1	25.57	1.056928384
3	0.76	0.24	24.43	27.57	1.124432598
4	0.66	0.34	24.91	29	1.159866706
5	0.56	0.44	25.59	30.42	1.184888936

6	0.46	0.54	26.45	31.85	1.200425799
7	0.36	0.64	27.47	33.28	1.207798206
8	0.3	0.7	28.15	34.13	1.208917233
9	0.16	0.84	29.93	36.13	1.203937062
10	0.06	0.94	31.33	37.56	1.195464103
11	0	1	32.22	38.41	1.188967042

In the above table, we can observe various portfolios. Still, the best option for an investor to invest is 8th row because the Optimal Portfolio is found because of an increase in **Sharpe Ratio 1.208917233.** At this point, this Portfolio provides greater satisfaction to the customer. Now, we will compare this Risk and return with the Correlation for TCS and FCL Technologies, where there is a good return and Risk and has positive Correlation between these two companies, i.e., 71%, which means there will be an equal amount of risk and return. So this is the best Portfolio if the investor wants to invest in one where an investor can always expect positive outcomes from this particular Portfolio.

Table 7: Construction of 10 portfolios by changing % of the money invested in both the stocks

Portfolio	**Weight-TCS**	**Weight-WIPRO**	**Portfolio-Risk**	**Portfolio-Return**	**Sharpe Ratio.**
1	1	0	24.12255289	24.14660769	0.9968516933
2	0.96	0.04	23.81275965	24.7421031	1.034827691
3	0.86	0.14	23.2605597	26.23084162	1.123396941
4	0.76	0.24	23.04260126	27.71958013	1.198631171
5	0.66	0.34	23.16831948	29.20831865	1.25638455
6	0.56	0.44	23.63223016	30.69705717	1.294717298

7	0.46	0.54	24.41506291	32.18579568	1.31418034
8	0.39	0.61	25.13734107	33.22791265	1.317876563
9	0.26	0.74	26.81466847	35.16327272	1.307615373
10	0.16	0.84	28.36096965	36.65201124	1.288813877
11	0.06	0.94	30.09259831	38.14074975	1.264123136
12	0	1	31.20783912	39.03399286	1.24757093

We can observe different portfolios from the above table, but the best option for an investor to gain an optimal portfolio is the 8th row, where Sharpe Ratio is 1.317876563. To be more precise, we will also compare Correlation with Risk and Return. It has 51% of the Correlation and has 25.14 of Return for 33.23 for a portfolio where an investor will gain more Return, and less Risk or the investor will have an equal amount of risk and return.

Table 8: Construction of 12 portfolios by changing % of the money invested in both the stocks

Portfolio	Weight-TCS	Weight-TECH MAH	Portfolio-Risk	Portfolio-Return	Sharpe Ratio.
1	1	0	24.12255289	24.14660769	0.9968516933
2	0.96	0.04	23.79683645	24.3646935	1.019660472
3	0.86	0.14	22.91163597	24.90990801	1.082851876
4	0.76	0.24	21.91515003	25.45512252	1.156967782
5	0.66	0.34	20.79138375	26.00033703	1.245724543
6	0.56	0.44	19.51836508	26.54555154	1.354906081
7	0.46	0.54	18.06456786	27.09076605	1.494127413
8	0.36	0.64	16.3819336	27.63598056	1.680874873
9	0.26	0.74	14.39041295	28.18119507	1.951382158

10	0.16	0.84	11.93638641	28.72640958	2.398247559
11	0.01	0.99	6.2719125	29.54423134	4.694617685
12	0	1	5.674066041	29.5987528	5.198873714

I found that the 12th row is seen as an optimal portfolio from the above table. But is not advisable for an investor to invest in these portfolios because putting all the eggs in one basket is not good for an investor, depending on various factors. So, the investor can ignore this particular Portfolio and look for other portfolios that best suit an investor to invest.

Table 9: Construction of 12 portfolios by changing % of the money invested in both the stocks

Portfolio	Weight-INFO	Weight-HCL TECH	Portfolio-Risk	Portfolio-Return	Sharpe Ratio.
1	1	0	28.24	34.12	1.204653824
2	0.96	0.04	28	34.29	1.221082487
3	0.86	0.14	27.55	34.72	1.256799783
4	0.76	0.24	27.31	35.15	1.283597674
5	0.66	0.34	27.28	35.58	1.300341804
6	0.55	0.45	27.51	36.05	1.30663567
7	0.46	0.54	27.9	36.44	1.302619331
8	0.36	0.64	28.52	36.87	1.289403982
9	0.26	0.74	29.33	37.3	1.268364073
10	0.16	0.84	30.32	37.73	1.241161545
11	0.06	0.94	31.46	38.16	1.209477812
12	0	1	32.22	38.41	1.188967042

We can see in the above table, 6^{th} row has an optimal portfolio as there is an increase in Sharpe Ratio that is 1.30663567. But to understand more, we will compare Risk and

return with Correlation, whereas there is 27.51 is the Risk and 36.05 is the Portfolio return, and it has a more significant Correlation is 68%. So, from the available options, an investor can choose this Portfolio where there is less Risk and more Return. But is very difficult to find such riskless portfolios, so investors can invest in this particular Portfolio, which will amount to an equal amount of Risk and Return.

Table 10: Construction of 12 portfolios by changing % of the money invested in both the stocks

Portfolio	Weight-INFO	Weight-TECH MAHI	Portfolio-Risk	Portfolio-Return	Sharpe Ratio.
1	1	0	28.23945777	34.11877078	1.204653824
2	0.96	0.04	27.85350688	33.93797006	1.214854927
3	0.86	0.14	27.07534152	33.48596826	1.233076533
4	0.77	0.23	26.61772939	33.07916664	1.238992483
5	0.66	0.34	26.38852444	32.58196466	1.230912503
6	0.56	0.44	26.50241598	32.12996287	1.20856766
7	0.46	0.54	26.91946761	31.67796107	1.173052956
8	0.36	0.64	27.62595288	31.22595927	1.126692694
9	0.26	0.74	28.60043114	30.77395747	1.072499828
10	0.16	0.84	29.81663802	30.32195567	1.013593674
11	0.06	0.94	31.24635975	29.86995387	0.952749508
12	0	1	32.19502544	29.5987528	0.916251886

From the above table, we can measure the various portfolios out of that the best portfolios are 4th row which shows 1.238992483 as the highest Sharpe Ratio. Now to see more about this Portfolio other than Optimum Portfolio is will compare Risk and return with Correlation for this particular Portfolio. The Risk for this Portfolio is

26.72, and 33.08 is the Return of the Portfolio. The correlation for this individual Portfolio is 56%. So, an investor can ignore this Portfolio as it is more than 70% investing in Infosys and less in Tech Mahindra. Because as per my opinion, supporting more than 70% is like putting the majority of the eggs in one basket, which will be more risk in the future.

Table 11: Construction of 12 portfolios by changing % of the money invested in both the stocks

Portfolio	Weight-INFO	Weight-WIPRO	Portfolio-Risk	Portfolio-Return	Sharpe Ratio.
1	1	0	28.23945777	34.11877078	1.204653824
2	0.96	0.04	27.65244227	34.31537966	1.237336627
3	0.86	0.14	26.40396196	34.80690187	1.314458107
4	0.76	0.24	25.50383075	35.29842408	1.380123026
5	0.66	0.34	24.9897197	35.78994629	1.428185138
6	0.56	0.44	24.8855647	36.2814685	1.453913903
7	0.5	0.5	25.02281858	36.57638182	1.457724745
8	0.36	0.64	25.90743919	37.26451291	1.434511247
9	0.26	0.74	26.98692722	37.75603512	1.395343561
10	0.16	0.84	28.39291476	38.24755733	1.343559041
11	0.06	0.94	30.07965272	38.73907954	1.284558698
12	0	1	31.20783912	39.03399286	1.24757093

From the above table, we can see so many possible portfolios. Still, as an investor, it's always better to choose the best optimum Portfolio with the highest Sharpe Ratio, 1.457724745. Now will compare the Risk and Return of the investor to Correlation. Its Risk is 25.02, and its Return is 36.76. It correlates with less than 50%, 46%, but the decision will be based on the highest Sharpe Ratio with more returns and less risk.

This is the best Portfolio because making half of the investment in one company and the remaining half in another is good.

Table 12: Construction of 12 portfolios by changing % of the money invested in both the stocks

Portfolio	Weight-HCL	Weight-WIPRO	Portfolio-Risk	Portfolio-Return	Sharpe Ratio.
1	1	0	32.22	38.41	1.188967042
2	0.96	0.04	31.56	38.44	1.214663886
3	0.86	0.14	30.09	38.5	1.276329344
4	0.76	0.24	28.89	38.56	1.331196319
5	0.66	0.34	28.02	38.62	1.374953514
6	0.56	0.44	27.49	38.69	1.403458164
7	0.46	0.54	27.34	38.75	1.413694895
8	0.36	0.64	27.56	38.81	1.404624565
9	0.26	0.74	28.15	38.87	1.377497037
10	0.16	0.84	29.08	38.93	1.335453904
11	0.06	0.94	30.33	39	1.282645908
12	0	1	31.21	39.03	1.24757093

The above table shows different portfolios for an investor. Still, as a rational investor, it's always advisable to prefer the optimum Portfolio, which has the highest Sharpe Ratio in the above table, 1.413694895, in the 7^{th} column. To understand better about Optimal Portfolio will compare Risk and return with Correlation for this particular Portfolio which determines 49%. So, the investor can invest in this specific Portfolio as there is a higher Return and higher Sharpe ratio.

Table 13: Construction of 12 portfolios by changing % of the money invested in both the stocks					
Portfolio	**Weight-HCL**	**Weight-TECH MAHI**	**Portfolio-Risk**	**Portfolio-Return**	**Sharpe Ratio.**
1	1	0	32.22	38.41	1.188967042
2	0.96	0.04	31.82	38.06	1.193034854
3	0.83	0.17	30.71	36.92	1.198891964
4	0.76	0.24	30.25	36.3	1.196683325
5	0.66	0.34	29.77	35.42	1.186164448
6	0.56	0.44	29.52	34.54	1.166483077
7	0.46	0.54	29.49	33.65	1.137626454
8	0.36	0.64	29.7	32.77	1.100210862
9	0.26	0.74	30.12	31.89	1.055417867
10	0.16	0.84	30.76	31.01	1.004830763
11	0.06	0.94	31.6	30.13	0.9502188025
12	0.01	0.99	32.09	29.69	0.9219545978

We have noticed in an above table, portfolios available, but as a rational investor, it is always good to recognize the Portfolio with the highest Sharpe ratio. But in this Portfolio, we can see the 3rd row as an optimal portfolio. Still, as a rational investor, it's advisable to reject this Portfolio as an investor has to invest more than 80% of his money in HCL and the remaining 17% in Tech Mahindra. So, investing 83% in HCL is similar to putting all the eggs in one basket where an investor can incur losses in the future rather than gain. Here the decision will also not be based on Returns and Risk because the returns will decrease continuously for this Portfolio.

Table 14: Construction of 12 portfolios by changing % of the money invested in both the stocks					
Portfolio	**Weight-WIPRO**	**Weight-TECHMAHI**	**Portfolio-Risk**	**Portfolio-Return**	**Sharpe Ratio.**
1	1	0	31.20783912	39.03399286	1.24757093
2	0.96	0.04	30.70962177	38.65658326	1.255521268
3	0.86	0.14	29.63308217	37.71305925	1.269292848
4	0.78	0.22	28.95958389	36.95824005	1.272747571
5	0.66	0.34	28.28974005	35.82601124	1.262861065
6	0.56	0.44	28.06172725	34.88248723	1.239499156
7	0.46	0.54	28.14218361	33.93896323	1.202428486
8	0.36	0.64	28.52849941	32.99543922	1.153072888
9	0.26	0.74	29.20854117	32.05191521	1.093923693
10	0.16	0.84	30.16244841	31.10839121	1.028046224
11	0.06	0.94	31.36524397	30.1648672	0.9585408367
12	0	1	32.19502544	29.5987528	0.9162518865

From the above table, we can make many portfolios, but the best decision for an investor will be based on Optimal Portfolio, which has the highest Sharpe Ratio. But this investor can decide to invest based on the market condition for this Portfolio, or he can reject it because investing more than 75% is not good in one company. But in another way, if we look into Portfolio returns other than Sharpe Ratio Returns for this particular Portfolio keeps on decreasing by the way Risk for the Portfolio increasing. So, an investor can reject this Portfolio and look into other different portfolios.

DISCUSSION:

For selecting the best Portfolio after analysing market conditions and noticing that if the company doesn't have any business problems, the Markowitz model helps in knowing which Portfolio is best for an investor from the number of available opportunities under different portfolios. I would like to compare individual stock

returns with the portfolios created using the Markowitz model. When we notice particular stock for all the top-five IT companies, Expected Return is suitable for all the companies. But as a rational investor, it is always good to invest the money in two companies because in case if investor incurs a loss in one company, they would gain in another company. So as a middle-class person, they would like to invest in two companies and more than that. So, Markowitz helps the investor maximise the returns for the same level of Risk, or some portfolio's returns will be more than the Risk. So, from the analysis, I have found ten portfolios in this particular Top 5 IT companies. Out of these 10 Portfolios, the best portfolios are TCS and Infosys, TCS and Wipro, Infosys and HCL Technologies, Infosys and Wipro and HCL Technologies and Wipro. These are the best portfolios that the investor can prefer to invest in. But other five portfolios have their ratio in such a way that investing more than 70% in one company and 30% in another company. So in my opinion, a rational investor will not invest in such a Portfolio. An investor should reject that particular Portfolio and choose the best Portfolio which maximizes returns and minimize the Risk or maximize the Return for the same amount of Risk. So, it is always essential for an investor to prepare a portfolio that helps in decision making of which is the best Portfolio instead of choosing random two companies and investing in those companies, which can cause issues in future.

SUGGESTIONS:

1. TCS and Infosys are useful for one who wants to take more risk as the price of TCS are more than 3500 and Infosys is more than 1500. But when we notice through Demography wise one who wants to invest in the stock market with Rs. 5000 or more can invest in this particular portfolio.

2. TCS and Wipro are useful for one who wants to invests more than Rs 4000 and since the investment is more even risk will also be more as there will be a volatility in stock market. Currently the stock price of TCS is more than Rs.3500 and Wipro’s stock price is more than Rs. 500.

3. Infosys and Wipro are useful for one who will have minimum risk as the price of Infosys may reach to Rs. 2000 and Wipro is near to Rs. 600. It keeps on

fluctuating depending on daily price rates. The one who are interested to invest more than 2500 in stocks then this particular portfolio is useful.

4. Infosys and HCL Technologies are useful for one who wants to invest more than Rs. 2000 in stocks then this particular portfolio is useful, as Infosys is currently having a price of more than Rs. 1500 and Wipro has more than Rs. 500.

5. HCL Technologies and Wipro are useful for one who wants to invest more than Rs. 1500. The risk may vary from high to medium depending volatility in stock market.

MANAGERIAL IMPLICATIONS:

Investment portfolios which are part of shareholders investments will be used by IT companies long term activities, ongoing IT services, different projects depends latest technologies as and when the technology transforms it demands IT companies to come up with different new projects which helps the company to invest in these shareholders capital and get more profit and also helps to keep good market condition, so shareholders will get better return on their investment.

CONCLUSION:

The above discussion shows how the Markowitz model plays an important role in selecting the best portfolios compared to individual stock returns and Risk. Investment is always subjected to risk. Markowitz Model made it easy for an investor to invest in the best portfolio. So, after researching the company profile and its market condition, it is always advisable for an investor to create portfolios of those companies and choose the best Portfolio from the number of available portfolios and invest in those portfolios rather than investing in an individual company or two random companies. Because investing in a particular company is "putting all the eggs in one basket", investing in random two companies can make an investor incur more Risk. It is similar to individual stock if an investor invests more than 70% in one company and the remaining 30% in another company where there will be a more chance of making a loss than a gain. The correlation will also help an investor know the compensation between the higher Risk and higher Return and the Markowitz model, allowing

potential investors to decide based on the best Portfolio available from several portfolios.

LIMITATIONS:

This research is valid only for investors who want to invest in two companies instead of one company. But future researchers can concentrate on other models that include more than three companies in each Portfolio and can try to link with other sectors that have more earnings and make it easy for an investor to choose the best Portfolio for their decision-making. Also as the data becomes old in the upcoming future days this can be used for education purpose for getting more practical idea of what is Markowitz model through Sharpe Ratio and you can decide the best portfolios for the analysis.

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