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An Analytical Study on Harry Markowitz Portfolio Construction of Selected Industries

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ABSTRACT

Risk and return are two faces of the same coin, Investments made by the investors are certain whereas the returns expected are uncertain when measured known as risk. The primary objective of the paper is to study the risk and return measures available for decision making, secondly to apply the techniques of beta and standard deviation for analyzing the risk and expected return for analyzing the return and to construct an optimal portfolio by applying Harry Markowitz portfolio construction technique. The Methodology applied is analytical and descriptive and application of Harry Markowitz portfolio Risk and Return techniques for the construction of an optimal portfolio.

Keywords: Beta, Standard deviation, Harry Markowitz, volatility, Correlation.

JEL: D53, E44, G11

Introduction

Risk is the uncertainty quantified and compared with the reward gained by an investor over a period of holding his shares. Risk and Return are two faces of the same coin. An investor invests in the market with an intention of returns in the near future, the investments investor does is certain whereas the returns are uncertain and when those uncertain returns are quantified it is termed as risk. There are risks which are common throughout for all the investors known as systematic and there are risks which are firm-specific or industry-specific known as unsystematic risk. The systematic risk is measured using Beta whereas the unsystematic risk is measured using Variance and standard deviation.

Objectives of the Paper

1. To study the risk and return measures available for Decision making
2. To analyze the risk through Beta and Standard deviation.
3. To correlate among various selected companies
4. To construct an optimal portfolio based on portfolio risk and return.

Scope of the Study

The study is restricted for ten industries and five companies in each industry, for a period of 6 years from Jan 2012 to Jan 2018.

Review of Literature

Dr S Poornima and Swathiga P(2017): Observed that the authors have studied the relationship between risk and return with the help of CAPM. The authors have taken five automobile and five IT companies for the study. The authors have applied the study by CAPM model and found that the automobile sector had positive returns with low risk, whereas the IT sector had shown a negative return with high risk. **B.Vijayalakshmi (2017)**: The aim of the paper was to construct a portfolio of three sectors which includes IT, Telecommunication and automobile. The paper focuses on Risk and return of the sector by considering three companies in each sector and the methodology applied is Markowitz portfolio construction by analysis portfolio return and risk. The correlation was applied to pick the stocks based on the negative correlation as it diversifies the risk of the stocks when it is included in the portfolio. **Dr M.Muthu Gopalakrishnan and Amal Vijay A K (2017)**: Observed from their study that as the return is high the expected risk from the asset will also be high, Investors should come to know the risk before investing in equity markets. The authors have analyzed the pharmaceutical industry which helps investors to make informed and rational investment decisions. They have used Excel for analyzing the data and their outcome of the study was sun pharmaceutical provided high returns with high market risk, they said Divi's laboratories ltd is more favourable to potential investors because it was given high return with minimal risk. **Dr. Prashanth B. Ashturkar, AbdulelahMahmood A.A Bazi (2015)**: The authors have taken Banking sector for analyzing Risk and return relationship, the aim of the paper is to understand the economic situation of the Indian Banking system and the impact of global business environment on the risks that Indian Banks face and profit return profile for the Indian Banks in the country..**Dinesh Tandon, Dr NidhiWalia (2015)**: The authors have analyzed the risk and return and aimed at dividend announcements as a signal and how it can be perceived by the investors in the market. They have studied the performance of 25 Indian companies in relation to its Benchmark Index and this relationship found for the period 2009-2013. The tools used were alpha, slope, and r-square and through regression, these values were obtained. **Arti Sharma(2015)**: The study was conducted on various sectors and was found

that the funds provide diversification within a particular sector and investing in sectoral funds is less risky than equity shares. **Kolani Pamane and Anani Ekoue Vikpossi (2014)**: noted from the paper that the relationship between expected return and the risk-free rate is linearly related to nonreversible risk measured by its beta. This relationship according to the authors can be well studied through CAPM. The outcome of the study showed that the relationship between beta and expected return is linear and found CAPM adequately captures all the information of returns and residual variance of stocks. The results further showed that residual risk has no effect on the expected returns of the whole period and the sub-periods except 2003-2008. **Dr P Vikkraman and P Varadharajan (2009)**: noted that the authors tried to focus on automobile Industry for their study and had studied that automobile industry multiplier effect on the growth of the country and has a capable of driving the economic growth. The objective of their paper is to maximize the expected returns for the Investments and the authors have taken the historical data for analyzing the expected returns. The authors have also analyzed the return using Alpha and risk through Beta.

Research Gap

From the above literature survey, it is evident that few companies were studied in the previous Studies. Hence this article focuses on multiple industries in analyzing the risk and return of the selected companies and portfolio risk and returns and assesses its relationship in taking Investment decision of those multiple industries.

Statement of the Problem

The stocks volatiles based on multifactor, assessing the right stocks for inclusion in the optimal basket is a necessity, also advisable to check the volatility which causes losses for the Investment made by the investors.

Instruments for Analysis

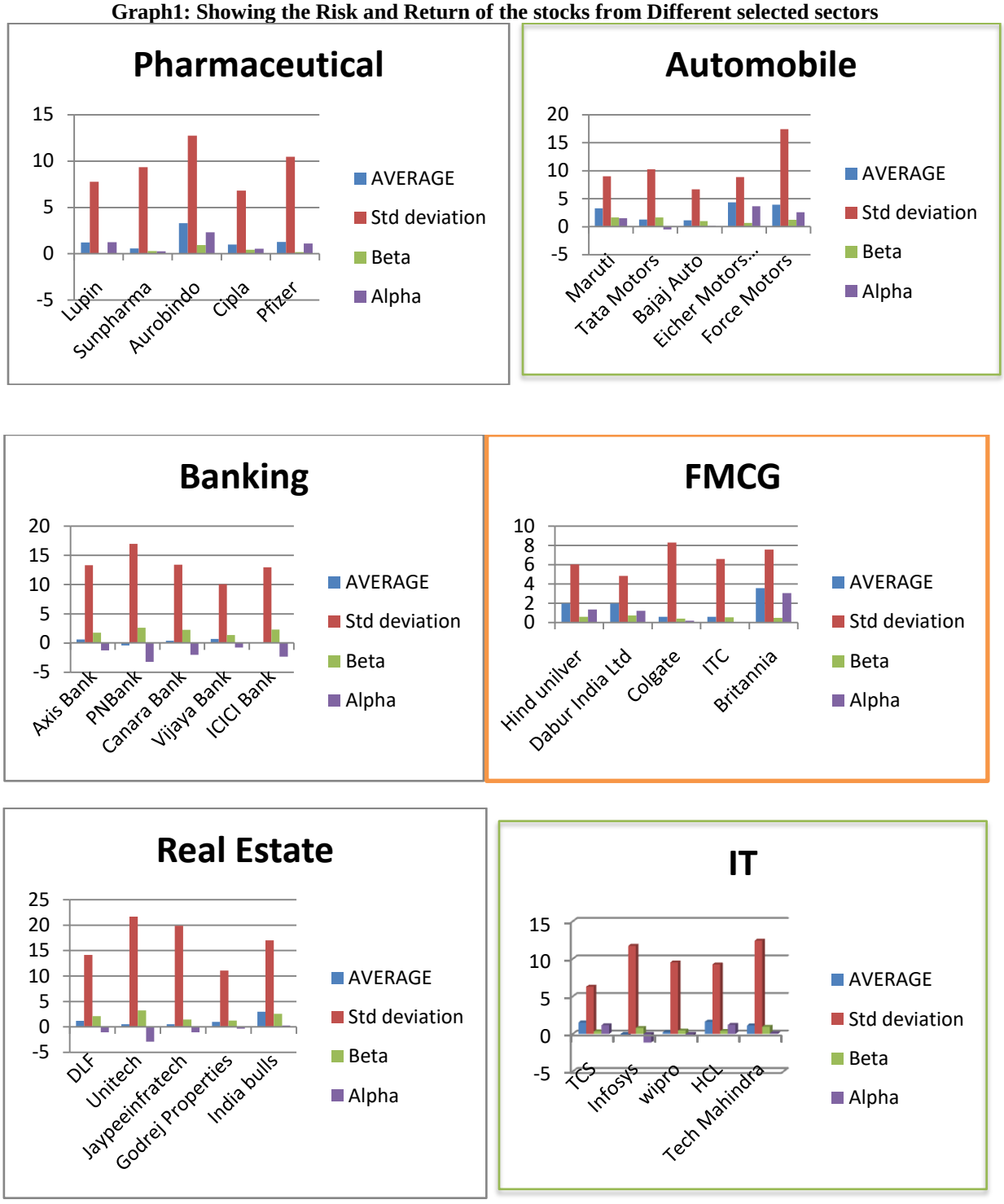
The risk of the financial assets are measured through beta, standard deviation and the return of the stocks are measured through average and Alpha to assess the risk and return of the selected securities.

Table 1: Showing the Risk and Return of the stocks from different selected sectors

Sector	Company	AVERAGE	Standard Deviation	Beta	Alpha
Pharma	Lupin	1.22459873	7.784472993	-0.01649	1.242158
Pharma	Sunpharma	0.58051287	9.348751943	0.289418	0.27226
Pharma	Aurobindo	3.30043262	12.73573834	0.935825	2.303705
Pharma	Cipla	0.99457939	6.825331681	0.417873	0.549512
Pharma	Pfizer	1.2819	10.46172643	0.162653	1.108618
Automobile	Maruti	3.29681298	9.026482606	1.651772	1.537546
Automobile	Tata Motors	1.27980772	10.29204526	1.663416	-0.49186
Automobile	Bajaj Auto	1.16431763	6.698365355	0.998311	0.101039
Automobile	Eicher Motors Ltd	4.35624459	8.87908677	0.667803	3.644983
Automobile	Force Motors	3.92336762	17.42761493	1.242609	2.599892
Banking	Axis Bank	0.61899962	13.30689567	1.771847	-1.26816
Banking	PNBank	-0.39117956	16.96929152	2.64051	-3.20353
Banking	Canara Bank	0.39788859	13.41921815	2.268453	-2.01819
Banking	Vijaya Bank	0.70050144	10.06252917	1.361569	-0.74968
Banking	ICICI Bank	0.10592582	12.94509649	2.29143	-2.33463
FMCG	Hindustan Uniliver	1.97844496	6.013653201	0.603051	1.336149
FMCG	Dabur India Ltd	1.98474155	4.836329718	0.731937	1.205171
FMCG	Colgate	0.60608088	8.300784566	0.402431	0.17746
FMCG	ITC	0.58274091	6.581346939	0.534517	0.013439

FMCG	Britannia	3.56936324	7.573942149	0.497972	3.038984
Real estate	DLF	1.1770728	14.14688366	2.092421	-1.05152
Real estate	Unitech	0.5543911	21.66737911	3.231273	-2.88717
Real estate	Jaypeeinfratech	0.52189058	19.87482252	1.472848	-1.04681
Real estate	Godrej Properties	0.96726036	11.08114308	1.234456	-0.34753
Real estate	India bulls	2.97445903	17.00678346	2.556786	0.251281
IT	TCS	1.53214041	6.286544415	0.342055	1.167825
IT	Infosys	-0.29758981	11.73437185	0.801337	-1.15108
IT	Wipro	0.23374162	9.530209436	0.441209	-0.23618
IT	HCL	1.62126564	9.264094471	0.390771	1.205064
IT	Tech Mahindra	1.12472984	12.43595439	0.961095	0.101088
Telecom	AIRTEL	0.78358251	8.684961295	1.059676	-0.34506
Telecom	Idea	0.66894639	11.07685505	0.749441	-0.12927
Telecom	Relaincecomm	0.83589543	28.00463135	2.174673	-1.4803
Telecom	Tata com	1.8670027	9.489404401	1.215138	0.572785
Telecom	MTNL	0.90605853	15.9510888	1.722337	-0.92837
Textile Exports	Mandhana textiles	-2.34894472	18.95943855	0.150913	-2.50968
Textile Exports	Bombay Dying	1.49462966	18.60588407	2.056117	-0.6953
Textile Exports	Bombay Rayon	-0.79658596	11.93450673	0.409776	-1.23303
Textile Exports	Raymond Ltd	2.13681169	10.34121768	1.25745	0.797529
Textile Exports	Sutlej textiles	2.0548646	15.50572754	1.113106	0.869319
Power Industry	JSW Energy	1.50729823	12.65565317	2.082478	-0.7107
Power Industry	NHPC	0.92459012	9.177450646	1.088422	-0.23466
Power Industry	NTPC	0.25921474	7.432983423	0.896117	-0.69522
Power Industry	Reliance power	0.69175022	9.202532595	1.154866	-0.53827
Power Industry	Power grid	1.0367712	5.601910141	0.81511	0.168615
Entertainment	Zee entertains	2.37001314	6.609617875	0.923551	1.386359
Entertainment	TV 18 Broad cast	1.84383915	14.04396027	2.040363	-0.32931
Entertainment	Dish TV	0.79562519	11.04083066	1.6957	-1.01043
Entertainment	PVR Ltd	3.75095001	9.486408323	0.773725	2.926873
Entertainment	Hathway Cable	0.20521828	15.20497091	0.736408	-0.57911

Graph1: Showing the Risk and Return of the stocks from Different selected sectors



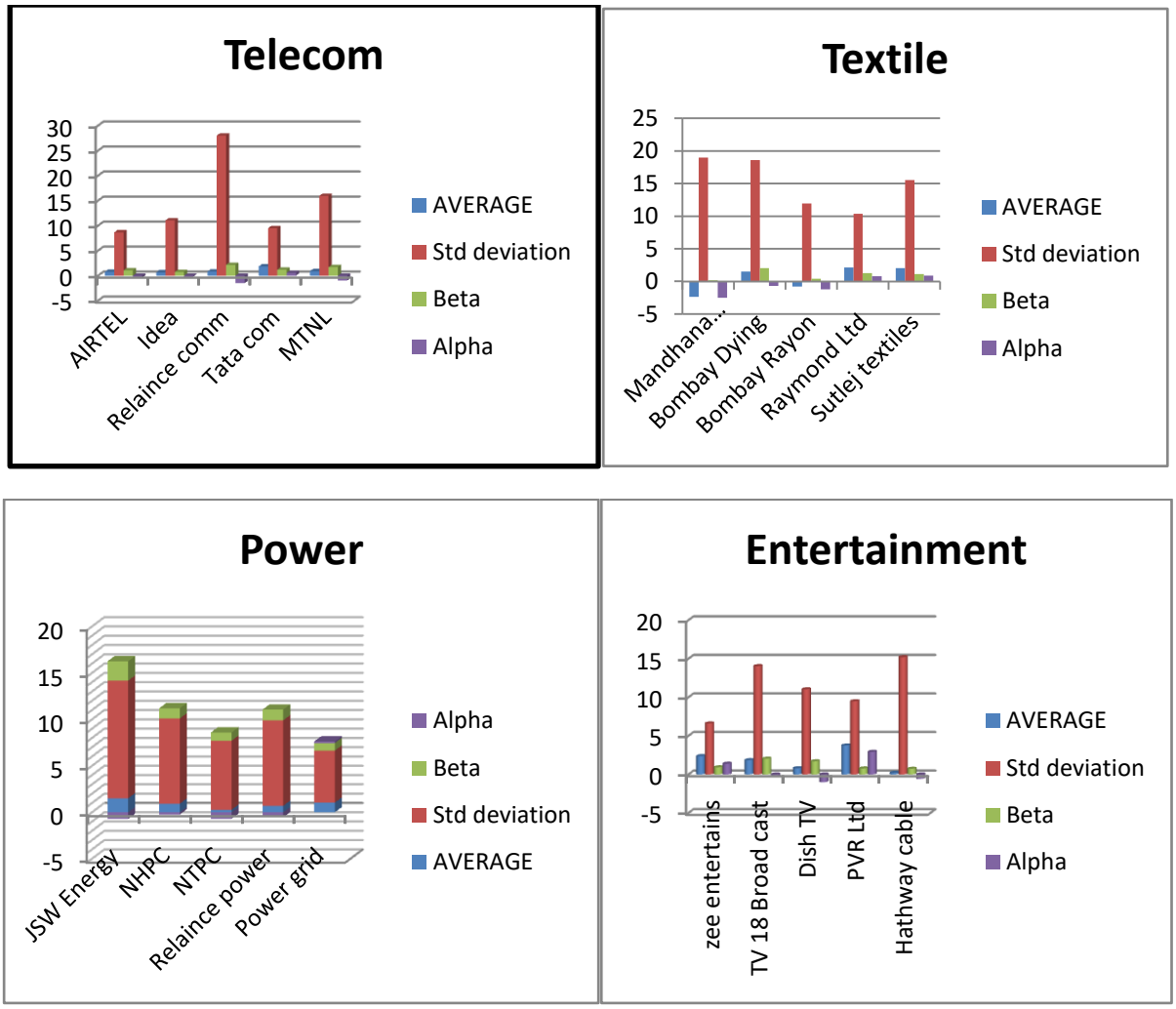


Table 2: Showing the Industry-wise Correlation Analysis

1.Pharmaceutical Industry

	LUPIN	*Sun Pharma*	*Aurobindo*	*Cipla*	*Pfizer*
LUPIN	1				
Sun Pharma	0.391917548	1			
Aurobindo	0.188937051	0.259319	1		
Cipla	0.26372081	0.219718	0.187565	1	
Pfizer	0.021633789	0.069369	0.20052	0.142928	1

2. Automobile Industry

	Maruti	*Tata Motors*	*Bajaj Auto*	*Eicher Motors Ltd*	*Force Motors*
Maruti	1				
Tata Motors	0.418368	1			
Bajaj Auto	0.431592	0.441461	1		
Eicher Motors Ltd	0.292044	0.283609	0.2579111	1	
Force Motors	0.378725	0.272074	0.1868422	0.221012	1

3. Banking Industry

	Axis Bank	*PNBank*	*Canara Bank*	*Vijaya Bank*	*ICICI Bank*
Axis Bank	1				
PNBank	0.311255	1			
Canara Bank	0.570271	0.647853	1		
Vijaya Bank	0.441047	0.555628	0.676005	1	
ICICI Bank	0.3103	0.763171	0.407949	0.337236	1

4. FMCG Industry

	Hind Unilever	*Dabur India Ltd*	*Colgate*	*ITC*	*Britannia*
Hind Unilever	1				
Dabur India Ltd	0.465743	1			
Colgate	0.36125	0.148	1		
ITC	0.246101	0.324801	0.123587	1	
Britannia	0.166228	0.349776	0.181292	0.075075	1

5. Real Estate Industry

	DLF	*Unitech*	*Jaypee Infratech*	*Godrej Properties*	*India Bulls*
DLF	1				
Unitech	0.539770515	1			
Jaypee infratech	0.481954531	0.654987	1		
Godrej Properties	0.411762297	0.34711	0.139703	1	
India Bulls	0.544449204	0.456352	0.333021	0.423925	1

6. IT Industry

	TCS	*Infosys*	*Wipro*	*HCL*	*Tech Mahindra*
TCS	1				
Infosys	0.501239	1			
Wipro	0.585801	0.451778421	1		
HCL	0.490281	0.398100367	0.430463	1	
Tech Mahindra	0.330118	0.329980554	0.290479	0.652072	1

7. Telecom Industry

	AIRTEL	*Idea*	*Relaince comm*	*Tata com*	*MTNL*
AIRTEL	1				
Idea	0.678013	1			
Relaince comm	0.305147	0.345491	1		
Tata com	0.138972	0.064994	0.0428	1	
MTNL	0.076164	0.014509	0.287439	0.280623	1

8. Textile Industry

	Mandhana textiles	*Bombay Dying*	*Bombay Rayon*	*Raymond Ltd*	*Sutlej textiles*
Mandhana textiles	1				
Bombay Dying	-0.06168	1			
Bombay Rayon	-0.23294	-0.07318	1		
Raymond Ltd	-0.10508	0.514126	0.008048	1	
Sutlej textiles	-0.0083	-0.10813	0.112259	0.18122	1

9. Power Industry

	JSW Energy	*NHPC*	*NTPC*	*Relaince power*	*Power grid*
JSW Energy	1				
NHPC	0.498426	1			
NTPC	0.489132	0.586803	1		
Relaince power	0.216728	0.321187	0.283763	1	
Power grid	0.394486	0.434311	0.628832	0.249495	1

10. Entertainment Industry

	zee entertains	*TV 18 Broad cast*	*Dish TV*	*PVR Ltd*	*Hathway cable*
zee entertains	1				
TV 18 Broad cast	0.237636	1			
Dish TV	0.460157	0.40558	1		
PVR Ltd	0.195904	0.195871	0.318259	1	
Hathway cable	0.198544	0.251574	0.15614	0.203122	1

The above analysis indicates a positive correlation among all the companies except Textile indicating the assets to be risky. From the above sector-wise correlation analysis, it is evident that there is a negative correlation between Mandana Textiles and Bombay Dying and Bombay rayon to an extent of –o.06168 and -0.10508, it is also evident that there is a negative correlation between Bombay rayon and Bombay dying.

The above indicates a further study in the construction of a portfolio using the blend of all the sectors. The present study focuses on the sector than the blend of all the sectors and based on the sectors selected, a portfolio is constructed.

Construction of a Portfolio based on Harry Markowitz Model

Harry Markowitz has identified the effect of diversification in the minimization of risk by coining " do not put all the eggs in one basket" Harry Markowitz has developed a formulae for the construction of a portfolio which is used by majority of Mutual Fund houses and a large retail and institutional investors in the process of minimization of risk. Harry Markowitz formula for expected return and risk is shown below and applied for the construction and decision making based on constructed portfolio.

1.Expected Return

ERp= WA*RA+WB*RB+WC*RC+WD*RD+WE*RE

The above formula is applied for five stocks and it can be extended for n number of stocks selected by the investor. Equal weights (proportion of Investment) is assumed for the calculation of Expected return and Risk.

2.Portfolio risk

S.D = $\sqrt{(WA^2 * \sigma A^2 + WB^2 * \sigma B^2 + WC^2 * \sigma C^2 + WD^2 * \sigma D^2 + WE^2 * \sigma E^2 + 2WAWBCOVAB + 2WAWCCOVAC + 2WAWDCOVAD + 2WAWECOVAE + 2WBWCCOVBC + 2WBWDCOVBD + 2WBWECOVBE + 2WCWDCOVCD + 2WCWECOVCE + 2WDWECOVDE)}$

1. Pharmaceutical Company

Weightage Company: A=20, B=20, C=20, D=25 and E=20.

Expected Return =1.47638

Standard deviation= 7.1395

2: Automobile

Weightage Company: A=20, B=20, C=20, D=25 and E=20.

Expected Return=2.8041

Standard deviation= 8.2131

3: Bank

Weightage Company: A=20, B=20, C=20, D=25 and E=20.

Expected Return =0.2864

Standard deviation = 11.2459

4: FMCG

Weightage Company: A=20, B=20, C=20, D=25 and E=20.
Expected Return = **1.74512**
Standard deviation = **5.87568**

5: Real Estate

Weightage Company: A=20, B=20, C=20, D=25 and E=20.
Expected Return= **1.239032**
Standard deviation = **12.8799**

6: IT

Weightage Company: A=20, B=20, C=20, D=25 and E=20.
Expected Return=**0.84285**
Standard deviation = 8.49789

7: Telecom

Weightage Company: A=20, B=20, C=20, D=25 and E=20.
Expected return =0.638871
Standard deviation = 9.14733

8: Textile Export

Weightage Company: A=20, B=20, C=20, D=25 and E=20.
Expected return = 0.5081634
Standard deviation = 7.78816

9: Power Industry

Weightage Company: A=20, B=20, C=20, D=25 and E=20.
Expected return = 0.8839248
Standard deviation= 7.7020

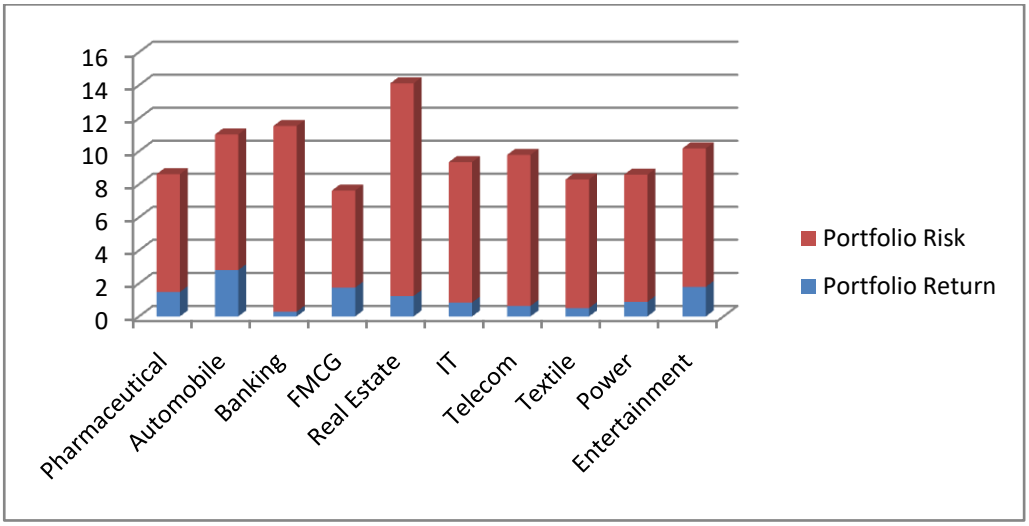
10: Entertainment

Weightage Company: A=20, B=20, C=20, D=25 and E=20.
Expected return = **1.793129**
Standard deviation= 8.38496

Table 2: **Showing the Portfolio Return and Portfolio Risk of various selected Industries**

Portfolio	Portfolio Return	Portfolio Risk	Portfolio	Portfolio Return	Portfolio Risk
Pharmaceutical	1.47638	7.1395	IT	0.84285	8.49789
Automobile	2.8041	8.2131	Telecom	0.63887	9.14733
Banking	0.2864	11.2459	Textile	0.50816	7.78816
FMCG	1.74512	5.87568	Power	0.88393	7.702
Real estate	1.23903	12.8799	Entertainment	1.79313	8.38496

Graph2: Showing the portfolio Return and Portfolio Risk of various selected Industries



Findings

1. PNB, Canara Bank, India bulls, DLF, JSW energy, and TV18 broadcast has shown a beta value of 2.268453,2.64051,2.556786, 2.082478 and 2.040363 respectively indicating the riskiness in the stocks towards a market action.
2. Dabur has the lowest standard deviation of 4.836329718 with an average return of 1.98474155 compared to all the stocks selected for the study.
3. The above analysis proves that the Automobile sector and Entertainment sector is giving a maximum return of 2.8041 and 1.793129 with a moderate rate of risk of 8.2131 and 8.38496 respectively.
4. FMCG sector has a minimum portfolio risk of 5.87568with a decent return of 1.74512 proving to be the optimum portfolio for long term investors.
5. Except for the Textile sector, all other sectors had positive correlation indicating the stock not to be a part of one portfolio where it becomes difficult in the diversification of the risk.
6. It is found that with the application of Harry Markowitz model, FMCG Sector has least portfolio risk compared to other sectors. The next least portfolio risk is found in Pharmaceutical followed by Power, Textile, Automobile, Entertainment, IT, Telecom, Banking, and Real Estate.
7. From the table 1 it is found that Companies like Force Motors, Tata Motors, Maruti individually has highest standard deviations of 17.42761493,10.29204526,9.026482606 whereas a combination of it will diversify the risk of the investors as it is pointed in table 2 which expresses to be 1.793129which proved to be the optimal portfolio as specified in the above finding.
8. Pharmaceutical, Automobile and IT sectors have the lowest beta values acting as a defensive platform for the investors.

Conclusion

The study on Risk and Return analysis proved to be effective for all long term investors and short term traders and fund houses to efficiently select the portfolios for obtaining a better risk-reward ratio. The Correlation with a blend of all the sectors can be an extension in the present study whereas the correlation sector-wise is analysed for checking the directional movement of the stocks which is used by most of the analysts for the selection of the stocks and Portfolio and that the Risk and Return will help most of the investors to categorize the stocks as aggressive and Defensive. The Harry Markowitz Portfolio construction technique is used for the computation of Risk and Return and the selection of the portfolio based on the Portfolio Risk and Portfolio Return.

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