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CAPM MODEL: UNDERSTANDING ITS EFFECTIVENESS IN ESTIMATING RETURNS IN THE INDIAN PHARMACEUTICAL SECTOR

MADHURA RANADE[1], ANIRUDDHA JOSHI[2]

[1] Symbiosis Institute of International Business (SIIB), Symbiosis, International (Deemed University) (SIU), Hinjewadi, Pune, Maharashtra, India

[2] Department of Management sciences, S P Pune University, Pune, Maharashtra, India

ABSTRACT:

This paper discusses the much debated Capital Asset Pricing Model and its application in the Indian Stock Exchange. Over the course of the study the researcher uses the CAPM model to ascertain the expected quarterly returns from 10 different stocks from the Indian Pharmaceutical sector over a period of five years. The expected returns are calculated for these stocks and compared with the actual returns from 2015 to 2019. The result of the various analysis conducted concluded that there is very little correlation between the expected and actual returns and other factors that influence the returns of a particular stock must also be factored in. Also the different stocks in the Pharmaceutical sector did not have a high correlation to the index, Nifty Pharma.

I. INTRODUCTION

The nineteen sixties saw an emergence of a model devised by (Sharpe, 1964), (Treynor, 1961) and (Lintner, 1965) termed as the Capital Asset Pricing Model (CAPM). Over time however there have been numerous models devised that can used to ascertain the asset pricing and expected return from an asset yet the CAPM has held on to its name. The inherent limitation of the CAPM model however is that it only considers the systematic risks involved in the calculation of cost of equity of a firm. The model seeks to find the added proceeds that an investor earns for taking the risk pertaining to a particular asset over and above an asset that does not have a risk or a minimal amount such as a financial instrument issued by the federal body of the country that the investor invests in which is symbolized by R_f . The underlying variables in the model include the yield from the market that the asset is a part of during the same time frame noted by R_m. The return of the stock/asset is given by R_i. This risk factor is represented by ß indicates the level of volatility in the stock in relation to the market.

$$Expected\ Return = r_f + ß(r_m - r_f)$$

Over the course of the study, the researcher will study how the investors perceived the risk involved in investing in the Indian Pharmaceutical sector and how the individual stocks returned their investments. The sector which is tipped for high growth in the coming years has been a precarious investment avenue over the last five years, 2015 to 2019. Over the period, it most of the stocks including the index have dipped in value and is contrary to the underlying belief of the model that the stock market gives a better return than federal instruments. Further the inherent quality of the CAPM model would also reveal how the individual stocks fluctuated in relation to its industry.

This study has been separated into sections, the following section constituents a concise literature review of the existing works done related to both the CAPM model. The section that follows will include the research methodology that the study will use. Later the data collected and analysed would be presented. The paper will finally be concluded with the findings and the conclusion.

II. REVIEW OF LITERATURE

One of the earliest attempts to evaluate the effectiveness of the CAPM Model was done in the 1970s by Fama and MacBeth where in the key interest was the average profit and risks associated with common stocks, they tested various hypothesis. Post the study however the researcher concluded that the ß is the only significant measure of

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risk and unsystematic risk is not present and later it was discovered through his study that the beta alone does not explain the risk return relationship as the CAPM model states.

It was in 1993 that Fama and French factored in the size and value components into the CAPM model hence formulating the Fama French three factor model. Studies conducted in Indonesia with focus on the coal mining sub sector divided stocks into efficient and inefficient based on whether the actual returns or anticipated yields was greater. Further (Nugraha et al., 2019) observed that the ß and the expected return has an inverse relationship more often than not. The study helped in identifying stocks that were investor worthy from those that were not. Size of the organisation, value of the firm, risks linked to the running of the firm, the way the source of funds was structured and fluctuations in share prices were the factors that(Laghi & Di Marcantonio, 2016) suggested in their study, they believed that involving such firm specific factors in estimating returns for the future will give more accurate results. This model was studied under varying conditions and was proved successful. Studies done in the Romanian stock exchange did not support the assumptions of the model as well, (Colescu & Papuc, 2013) studied the results of the model for three years. The formula was not able to provide accurate outputs for the expected results in the economy and hence advised against using it as an investment decision tool. The CAPM model only includes the market risk or the volatility of the stock in relation to the market it was observed by (Chaudhary, 2016) that there are other factors that need to be understood. Indian and US markets over a ten year period were studied and portfolios based on the ßs attained from the surplus earnings from the market were constructed for comparisons.

III. RESEARCH METHODOLOGY

The study was conducted based on the quarterly data of a period of five years, from January 1 2015 to December 31 2019; it is assumed for the research purpose that the investor buys the stock at the beginning of the quarter and sells it at the beginning of the next quarter to realise his/her returns.

The assets studied for this study were the shares of pharmaceutical companies in the Indian market and the NIFTY Pharma index used as the market return for the purpose of calculation. Ten top companies that constitute the Nifty Pharma index were considered for the study, i.e. non random sampling technique was used and the names of these companies are mentioned at various points in the study. Secondary data of the prices of the shares on various dates was collected from the Yahoo Finance and NSE sites and regression and correlation analysis was done using MS Excel. The yield rates of the ninety one day Treasury bill issued by the Government of India was used as the rate for the risk free rate of return in the formula as it gives returns on a quarterly basis and can be compared with the returns of the shares over the same period.

The following steps were carried out:

i. The actual returns of both the individual stocks and the index were calculated from the share prices over the twenty quarters of the five years under consideration.

ii. These returns were then compared with the relevant yield rates of the government security for the corresponding period to calculate the excess and ß was calculated using regression of the excess returns.

iii. The expected return over each quarter was then calculated using the CAPM model.

iv. The expected values calculated were then compared with the actual returns using correlation to identify the effectiveness of the results calculated using the CAPM model.

Further the paper also aims to study the relation between the performances of the individual stock with the index over the same period.

IV. DATA COLLECTION AND ANALYSIS

The CAPM model has been a matter of study in different countries with respect to different types of stocks, in this study the Indian Pharmaceutical sector is studied, the reason the researcher has chosen this sector is because of the varying and often negative returns of the sector in the last five years. The following graph shows the fluctuations in the Nifty Pharma index which gives an overview of the way that the sector has performed

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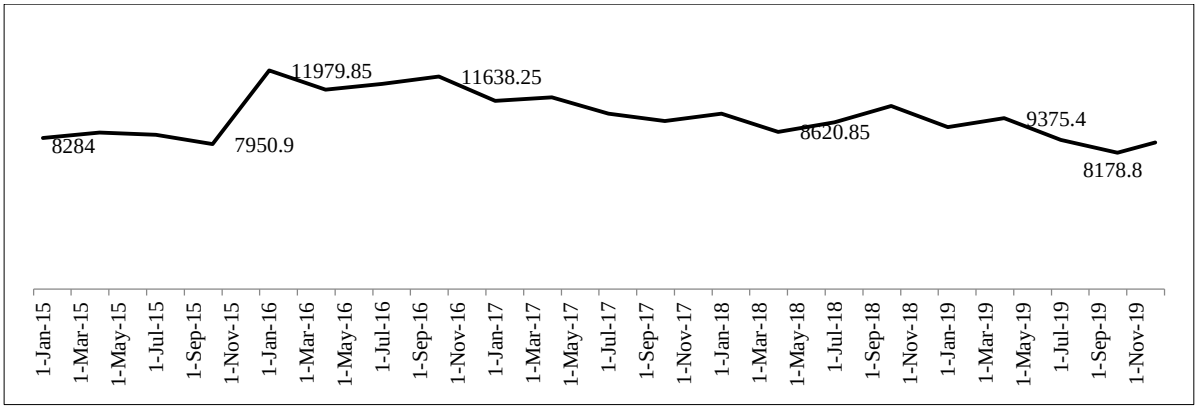
Chart 1: Prices of the Nifty Pharma Index over the last five years



An analysis of the prices of the stocks and the index on the first day of each quarter under study shows us that Pharmaceutical companies in the country have had a tough time over the last five years. All the stocks have depreciated in value over the time period except that of Divislab, Biocon and Piramal Enterprises. This is primarily due to the increasing regulations in the sector and the various negative news coming out in relation to the industry.

Table 1: Quarterly returns of the stocks, the index and the Treasury bill

Date	RF	Sun Pharma	DrReddy	Cipla	Divislab	Lupin	Biocon	Auro pharma	Cadila HC	Glenmark	PEL	NP returns
01-15	2.07	31.49	2.38	-8.59	-1.08	11.81	9.14	3.04	3.87	23.80	12.50	3.65
04-15	2.06	-19.24	23.14	11.49	13.82	-4.28	1.05	18.21	10.87	13.66	-1.91	-1.55
07-15	1.88	2.05	5.00	-2.62	17.64	13.69	-0.54	-1.23	10.45	-2.02	1.60	-5.94
10-15	1.76	-8.47	-27.44	-15.26	-1.12	-11.31	7.56	11.15	-27.02	-22.20	6.27	50.67
01-16	1.56	-0.06	-0.54	-8.22	-7.88	-6.05	19.63	-8.91	7.69	7.53	19.80	-8.78
04-16	1.81	-6.35	-4.96	-1.79	14.02	8.25	41.64	4.15	12.00	3.80	35.02	2.95
07-16	1.68	-0.83	14.58	9.05	6.79	-14.46	11.64	2.57	15.28	8.37	10.43	3.44
10-16	1.59	-16.25	-10.25	0.03	-45.30	-1.19	9.22	-16.01	-17.12	-4.20	-4.90	-11.41
01-17	1.80	9.20	-13.90	-3.11	-10.24	-9.00	9.17	-11.01	25.59	0.12	47.91	1.88
04-17	1.45	-20.28	-8.31	0.48	7.08	-22.89	4.57	18.43	23.49	-22.11	18.27	-8.45
07-17	1.56	-8.94	1.89	12.05	31.15	-0.38	-6.63	5.76	-7.39	-11.38	-6.91	-4.17
10-17	1.51	14.20	-8.35	-5.65	17.78	-14.04	71.19	-17.16	-15.42	-1.86	0.39	4.38
01-18	1.56	-11.53	-5.19	2.58	15.21	-8.17	8.57	1.98	-3.16	-5.69	-5.23	-10.37
04-18	1.52	10.89	0.85	5.59	-4.01	1.58	-12.16	-7.86	-7.49	1.76	3.09	5.95
07-18	1.6	12.71	19.49	-1.89	29.15	7.41	12.38	33.81	-5.61	6.83	-18.92	9.86
10-18	1.78	-31.69	7.01	-17.79	1.46	-1.10	-1.62	-0.47	-11.42	4.85	-6.46	-11.48
01-19	1.66	10.45	7.83	9.22	15.98	-0.42	-8.45	3.97	2.04	-2.03	16.21	5.56
04-19	1.5	-15.35	-12.24	-7.77	-6.47	-12.30	-23.66	-30.25	-30.00	-33.26	-23.42	-12.76
07-19	1.49	-4.64	8.10	-10.41	7.42	-2.58	8.63	-17.75	10.51	-25.97	-6.89	-8.71
10-19	1.33	11.90	5.54	2.87	8.20	1.19	16.94	1.28	7.33	11.60	-5.91	7.68

**all figures are in percentages*

The above table shows the double digit drops in the value of stocks over the space of just three months, although there were occasional spikes in the index that kept it afloat and averaged out the losses. However investors in most of the ten stocks continued to lose money.

Given the returns, the beta of each stock over the five years in relation to the index is attained by running a regression analysis with the excess returns over the risk free rate of each stock to that of the index.

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Table 2: Beta of the stocks under consideration

Stock	Sun Pharma	Dr Reddy	Cipla	Divislab	Lupin	Biocon	Auro pharma	Cadila HC	Glenmark	PEL
Beta (ß)	0.338	-0.265	-0.089	0.141	-0.016	0.219	0.381	-0.275	0.002	0.172

The above table gives us an idea of the varying nature of the individual stocks in relation to the index which is nothing but a weighted index of the same ten stocks. Surprisingly, none of the stocks have relation that can be termed as significant with index, with stocks like Glenmark having almost no relation to the index. A beta of 0.002 indicates that the movement of the stock has nothing to do with how the market or in this case the industry is performing. Stocks like DrReddy, Cipla, Lupin, etc. have a negative beta indicating that they move in the opposite direction as that of the index more often than not.

The expected returns of the stocks are calculated using the variables ascertained above.

Table 3: Expected returns using CAPM Model

Date	**Sun Pharma**	**DrReddy**	**Cipla**	**Divislab**	**Lupin**	**Biocon**	**Auropharma**	**Cadila HC**	**Glenmark**	**PEL**
01-15	2.61	1.65	1.93	2.30	2.05	2.42	2.67	1.64	2.08	2.34
04-15	0.84	3.02	2.38	1.55	2.12	1.27	0.68	3.06	2.05	1.44
07-15	-0.76	3.96	2.58	0.77	2.02	0.16	-1.10	4.04	1.86	0.54
10-15	18.31	-11.23	-2.60	8.70	0.93	12.51	20.44	-11.69	1.90	10.19
01-16	-1.94	4.31	2.48	0.10	1.74	-0.71	-2.39	4.41	1.53	-0.22
04-16	2.20	1.51	1.71	1.97	1.79	2.06	2.25	1.50	1.82	2.01
07-16	2.28	1.21	1.52	1.93	1.65	2.07	2.35	1.19	1.68	1.98
10-16	-2.81	5.04	2.74	-0.26	1.81	-1.27	-3.38	5.16	1.55	-0.65
01-17	1.83	1.78	1.80	1.81	1.80	1.82	1.83	1.78	1.80	1.82
04-17	-1.90	4.08	2.33	0.05	1.62	-0.72	-2.33	4.17	1.42	-0.25
07-17	-0.38	3.09	2.07	0.75	1.66	0.30	-0.63	3.14	1.55	0.57
10-17	2.48	0.75	1.26	1.92	1.46	2.14	2.61	0.73	1.52	2.01
01-18	-2.47	4.73	2.63	-0.13	1.76	-1.06	-2.99	4.84	1.53	-0.49
04-18	3.02	0.35	1.13	2.15	1.45	2.50	3.21	0.31	1.54	2.29
07-18	4.40	-0.57	0.88	2.78	1.48	3.43	4.76	-0.65	1.64	3.04
10-18	-2.71	5.30	2.96	-0.10	2.00	-1.14	-3.29	5.43	1.74	-0.51
01-19	2.98	0.62	1.31	2.21	1.59	2.51	3.15	0.59	1.67	2.33
04-19	-3.29	5.36	2.83	-0.48	1.80	-1.59	-3.92	5.49	1.51	-0.91
07-19	-1.96	4.20	2.40	0.04	1.66	-0.75	-2.41	4.30	1.46	-0.27
10-19	3.48	-0.36	0.76	2.23	1.22	2.72	3.75	-0.42	1.34	2.42

**all figures are in percentages*

The aim of the study was to find out the effectiveness of the CAPM model in estimating the returns from a stock over a given time period, the results have been summarised in the tables above. The following table however gives the correlation between the actual returns of these stocks with the expected returns that were calculated using the model. This helps in understanding the level of effectiveness of the model.

Table 4: Correlation between expected and actual returns of stocks

Stock	Sun Pharma	Dr Reddy	Cipla	Divislab	Lupin	Biocon	Auro pharma	Cadila HC	Glenmark	PEL
Correlation	0.31	0.31	0.13	0.11	0.29	0.14	0.37	0.25	0.42	0.16
Average	0.25									

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As can be observed there is very little correlation between the expected and the actual returns of the stocks as per the calculations.

V. FINDINGS

1. Among the ten companies under study from the sector chosen for the study only Sun Pharma and Aurobindo had at least a beta of 0.3, the others had even lesser betas showing that the stocks have been independent of the movement of the index. Stocks like Cadila HC had a negative beta which shows that the stock gave positive returns around 2016-2018, a phase when the index was itself returning in negative. Dr Reddy had a negative beta with the stock performing better than the index in 2015 and then continued to move in the opposite direction of the index in the following years as well. Glenmark had a beta of 0.002 showing that the volatility of the stock had almost nothing to with the way the index fluctuated.

2. The primary motive of the study was to calculate the expected returns of the stocks over the given time frame and compare it with the actual returns with the historical data at hand. The effectiveness of the model is judged by running correlation with the actual returns. It was found that model was able to predict the returns of the stock accurately in very few occasions, in fact the average correlation between the expected and the actual returns of the firms was just 0.25.

3. One major reason for this was certainly the huge fluctuations that the pharmaceutical sector witnessed in the time period under study, there was double digit growth or fall for the companies in the sector whereas the model seeks to simply add the beta integrated value of the excess returns of the market to that of the risk free return. Hence it was observed that often the CAPM model predicted returns just around the 2-3% mark over a quarter whereas the actual returns where at times even in double digit percentages in either positive or negative, hence the model was not successful in predicting them.

4. The highest correlation between the actual and expected return was for Glenmark at 0.42 and the lowest was for Divis Laboratories at 0.11. The intrinsic limitations of the CAPM model are further highlighted in this study as the various factors affecting the individual companies are not taken into consideration while calculating the expected returns; the model simply gives the excess over the risk free rate of return.

VI. CONCLUSION

Understanding the applicability of the CAPM model on the Indian stock market over a period of five years was the primary aim of the study. Five years of data segmented into twenty quarters were studied for the same. Over the course of the study it was observed the stocks and index did not have a great deal of relation in their respective volatilities. The study returned an average correlation of just 0.25 over the ten stocks once the expected and the actual returns were calculated. This shows that the model that only considers the market fluctuations and it's relation to the stock returns cannot always be used for attaining the expected returns. As recommended by earlier studies, it would be beneficial for the investor to factor in other factors such as size, age, value and other factors specific to the firm. Also the fact the sector under consideration in this case was the Pharmaceutical sector which was a challenge as well, as the sector's negative historic returns is against the primary assumptions of the model.

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