AN APPLICATION OF CAPITAL ASSET PRICING MODEL (CAPM)

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Abstract

The CAPM model was developed to explain the differences in the risk premium across assets. According to the theory these differences are due to differences in the riskiness of the returns on the assets. The model states that the correct measure of the riskiness of an asset is its beta and that the risk premium per unit of riskiness is the same across all assets. Given the risk free rate and the beta of an asset, the CAPM predicts the expected risk premium for an asset. In this paper the empirical testing of CAPM has done to test whether or not the theories should be rejected and to provide information that can aid financial decisions

Key Words: CAPM, Securities, Return, Required Return, Beta, performance of IT, Pharmaceutical & Telecom Sector.

1. Introduction

Investment decisions are found as the outcomes of three different but related classes of factors. The first may be described as factual or informational premises. The factual premises of investment decisions are provided by many streams of data which is taken together, represent to an investor the observable environment and the general and particular features of the securities and firms in which investor may invest. The second class of factor entering into investment decisions may be described as expectation premises. Expectations relating to the outcomes of alternative investments which are subjective and hypothetical in any case but their foundations are necessarily provided by the environmental and financial facts available to investors. These limit not only the range of investments which may be undertaken but also the expectations of outcomes which may legitimately be entertained. The third and final class of factors may be described as valuation premises. For investors generally these comprise the structure of subjective preferences for the size and regularity of the income to be received from, and for the safety and negotiability of specific investment or combinations of investments, as these are appraised from time to time.

One of the most important developments in modern capital theory is the capital asset pricing model (CAPM) as developed by Sharpe [1964], Lintner [1965] and Mossin [1966]. CAPM suggests that high expected returns are associated with high levels of risk. Simply stated, CAPM postulates that the expected return on an asset above the risk-free rate is linearly related to the non-diversifiable risk as measured by the asset's beta. Although the CAPM has been predominant in empirical work over the past 30 years and is the basis of modern portfolio theory, accumulating research has increasingly cast doubt on its ability to explain the actual movements of asset returns. The capital asset pricing model (CAPM) describes the relationship between risk and expected return, and it serves as a model for the pricing of risky securities.

The empirical testing of CAPM has two broad purposes

> (i)   To test whether the theories should be rejected or not.

(ii) To provide information that can aid financial decisions.

To accomplish (i) tests are conducted which could potentially at least reject the model. The model passes the test if it is not possible to reject the hypothesis that it is true. Methods of statistical analysis need to be applied in order to draw reliable conclusions on whether the model is supported by the data. To accomplish (ii) the empirical work uses the theory as a vehicle for organizing and interpreting the data without seeking ways of rejecting the theory. This kind of approach is found in the area of portfolio decision-making in particular with regard to the selection of assets to be bought or sold.

For example, investors are advised to buy or sell assets that according to CAPM are underpriced or overpriced. In this case empirical analysis is needed to evaluate the assets, assess their riskiness, analyze them, and place them into their respective categories. The commonly used formula to describe the CAPM relationship is as follows:

Required (or expected) Return = RF Rate + (Market Return – RF Rate) x Beta

2. Data collection

This study is based on the secondary data. The daily share price of 31 selected companies and daily closing index price of Sensex was downloaded from the PROWESS, the corporate data base of CMIE for a period of 10 years, i.e. From 1st April, 1999 to 31st March, 2010. In this study the required Risk-free rates for 10 years, collected from the RBI site and bulletins. Conceptual details relating to financial analysis are collected from books, journals and internet and prospectus of various asset management companies. This study examined ten IT, eleven Pharmaceutical and ten Telecom companies.

3. Sampling Design

The sampling method adopted in this study is judgmental sampling. Sampling data comprises of stocks listed on the Bombay Stock Exchange (BSE) for the period of April 1999 to March 2010. Each series consists of 10 year observation made at each day opening and closing price for each stock denominated in Indian rupees. The sample stocks were selected from the specified group of BSE.

4. Methodology

The methodology adopted for the study is as below,

1. As first requirement daily stock price of 30 selected companies and daily closing index price of Sensex was downloaded from the PROWESS software, the corporate data base of CMIE. Risk-free rates for 10 years are collected from the RBI site and bulletins.

2. In the next step, matched the daily stock price of companies with SENSEX index by using Microsoft Access. Then overall data has been divided in to yearly basis.

3. Calculated the Security return (Ri), Market return (Rm), Log return on securities (lnri) and Log return on market (lnrm) for security and the market with percentage for every day. The formula is given below,

$$Ri = \frac{P_i - P_{i-1}}{P_{i-1}} * 100$$

$$Rm = \frac{p_i - p_{i-1}}{p_{i-1}} * 100$$

Where, RI =Return on security

R_m =Return on Market index

P_t=Present day closing share price

P_{t-1}=Previous day closing share price

P_i= Present day closing index

P_{i-1}=Previous day closing index

4. In this stage, calculated the sum, average, number of days trading, Beta, Required return (Rs) and Required log return (lnrs) by using the following formula.

$R_s = R_f + \beta(R_m - R_f)$

Where,

R_s=the return required on the investment

R_F=the return that can be earned on a risk-free investment

R_m=the return on the market index

β=the security beta

5. After calculating of all these statistical items, copied all the calculated items to another excel sheet and calculated Variance, Standard deviation, Average Beta and

T Test has also been conducted.

6. At last made new final sheet of all those calculated result to make the tables of those data for the analysis and interpretation purpose.

5. Limitation of the study

- A detailed study of all the company could not be made due to the time constraints.
- It is very difficult to summaries the whole data which runs through several months and several years in few cases.
- Capital Asset Pricing Model mainly depends on assumptions
- This study is based on selected company securities, so the assumption basically depends on these securities.

The computer systems design and related services industry (IT) is one of the economy's largest and fastest sources of employment growth. The main growth catalyst for this industry is expected to be the persistent evolution of technology and business' constant effort to absorb and integrate these resources to enhance their productivity and expand their market opportunities. Employment of computer and information systems managers is expected to grow between 18 to 26 percent for all occupations through the year 2014. The Indian IT sector is growing rapidly and it has already made its presence felt in all parts of the world. IT has a major role in strengthening the economic and technical foundations of India. Indian professionals are setting up examples of their proficiency in IT, in India as well as abroad.

The Indian Pharmaceutical Industry is a success story providing employment for millions and ensuring that essential drugs at affordable prices are available to the vast population of this sub-continent. The Indian Pharmaceutical Industry today is in the front rank of India's science-based industries with wide ranging capabilities in the complex field of drug manufacture and technology. A highly organized sector, the Indian Parma Industry is estimated to be worth $ 4.5 billion, growing at about 8 to 9 percent annually. It ranks very high in the third world, in terms of technology, quality and range of medicines manufactured. The leading 250 pharmaceutical companies control 70% of the market with market

leaders who are holding nearly 7% of the market share.

India's Telecom Sector has shown massive upsurge in the recent years in all respects of industrial growth. From the status of state monopoly with very limited growth, it has grown in to the level of an industry. At present the country's telecom industry has achieved a growth rate of 14 per cent. Till 2000, though cellular phone companies were present, fixed landlines were popular in most parts of the country. Major players in the sector are BSNL, MTNL, Bharti Teleservices, Hutchisson Essar, BPL, Tata, Idea, etc. With the growth of telecom services, telecom equipment and accessories manufacturing has also grown in a big way.

6. Empirical Analysis

The investors assimilate the several bites of information related to the company and evaluate the present and future value of stock. The risk and return associated with the purchase of the stock is analyzed to take better investment decision. The valuation process depends upon the investor's ability to elicit information from the relationship and inter- relationship among the company related variables. The present and future values are affected by number of factors and they are; competitive edge, earnings, historical price of stock, stock market condition and economic condition. The study is analyzing the industry and company performance of three different sectors.

6.1. Analysis of I T Sector

The analysis of security returns of IT Sector is presented below.

Table No.6.1

Table showing Security Returns of IT Sector

Company	Avg Ri	Avg Rs	Avg Beta	Avg lnri	Avg lnrs	Avg Ln
TCS.	3.5504	21.2869	0.8632	-12.1253	17.1805	0.8628
Wipro Ltd.	12.0284	17.0999	1.2768	-15.9304	12.5441	1.2839
Infosys	18.9809	15.8340	1.1144	- 0.8639	11.8031	1.1012
H C L Tech	5.3136	14.3353	1.2746	-15.7939	10.0256	1.2776

Tech Mahindra	27.2762	14.8200	0.9242	12.2141	10.6614	0.9362
Patni Computer	25.4733	21.9496	0.7474	14.2804	18.8274	0.7508
I-flex	32.0813	21.0895	0.9496	18.9814	17.4128	0.9429
Silverline Tech.	70.2158	20.6838	1.9356	-37.3928	8.1415	1.4423
Mphasis	17.2417	12.7230	0.8125	- 5.1493	9.1673	0.8041
N I I T	0.0560	17.2201	1.1962	-30.4522	12.8787	1.1908
Average	**21.22176**	**17.70421**	**1.1094**	**- 7.2232**	**12.8642**	**1.0593**
T- test	**0.600356**			**0.0082**		

As per the above table, all the ten companies are having positive average returns so these companies stocks are giving positive returns. NIIT Ltd average returns are lowest (0.0560). So it's better to invest in those securities which are giving high/positive returns. In the case of average log return most of the companies showing negative value i.e. Negative return, so if the investors want to invest, they can invest on the company showing high/ positive return.

Seeing the above table, average log return shows clear picture than average return. The average return of IT sector is 21.22 and required return is 17.70 it means in this study IT sector's return is more than required. The t-test reveals that there is no significant difference between the security return and required return.

When considering these ten companies the beta value of five companies were below 1.00, but rest of five companies showed it to be more than one which is the indication that these companies stocks are very aggressive in nature .The companies with the aggressive stocks was**:** Silverline Technologies, NIIT Ltd, HCL Technologies Ltd, Wipro and Infosys. Overall average beta of IT Sector indicates aggressive in nature with a beta value of 1.1094.

The average log return of IT sector is -7.2232% and log required return is 12.86% it means in this study IT sector's return is more than required which indicate negative log return and positive required return in IT sector.

6.2. Analysis of Pharmaceutical Sector
The analysis of security returns of Pharmaceutical sector is presented below.

Table No. 6.2

Table showing Security returns of Pharmaceutical Sector

Company	Avg Ri	Avg Rs	Beta	Avg lnri	Avg lnrs	Ln
Aurobindo.	22.0549	12.9991	0.4711	5.8797	11.6494	0.4752
Dr. Reddy's	14.5068	14.1547	0.5826	2.8670	12.0304	0.5721
Sun Pharm	27.9468	12.6079	0.5362	10.9892	10.2472	0.5330
Cipla Ltd.	8.1818	17.7094	0.6636	-12.6344	16.0913	0.7248
Ranbaxy	8.7354	15.3150	0.7683	- 3.4569	11.8901	0.7679
Orchid Chem	17.4933	22.9742	0.9559	0.6797	19.5979	0.9711
Zandu Realty	21.9164	14.7357	0.4398	11.0754	13.0531	0.4401
Aventis Pharma	15.0231	12.7148	0.4319	8.4911	10.9862	0.4332
Cadila Healthcare .	26.8945	13.6019	0.5359	17.8803	11.7428	0.5362
Ipca Labo Ltd.	31.6551	19.4501	0.6783	19.4501	13.7386	0.6712
Lupin Ltd.	95.1662	21.8615	-0.0616	40.0660	14.6601	0.4822
Average	**26.3249**	**16.1931**	**0.5456**	**9.2079**	**13.2443**	**0.6006**
T-test	**0.1964**			**0.361579**		

All the pharmaceutical companies are having positive average returns. But in case of Cipla Ltd and Ranbaxy, average returns are less compare to other companies. In the case of average log return all the companies showing positive return, except Cipla and Ranbaxy. So it's better to invest in that company's security which gives high/ positive return. As per the above table the log return of Ranbaxy and Cipla, the study reveals that both companies have negative security return. The average log return is 9.2079 of this sector where five companies are showing log return above the sector's average. The study reveals that, average return of pharmaceutical sector is 26.32% but most of the companies earn below the average return. The t-test reveals that there

is no significant difference between the security return and required return.

The beta value of all the companies were below 1.00 and it is negative in the case of Lupin Ltd which is the indication that, the companies' stocks are very unaggressive in nature and the average beta of pharmaceutical sector is 0.5456 which indicates that pharmaceutical sector is unaggressive in nature.

The average log returns of pharmaceutical sector is 9.20% and log required return is 13.24%, it means pharmaceutical sector's return is less than required return.

6.3. Analysis of Telecom Sector

The analysis of security returns of It sector is presented below.

Table No. 6.3

Table showing Security returns of Telecom Sector

Company	Avg Ri	Avg Rs	Beta	Avg lnri	Avg lnrs	Ln
Idea	- 0.7176	15.4366	0.9656	-14.3364	9.6170	0.9688
MTNL	3.0764	18.8958	0.9747	- 7.8829	15.1552	0.9770
R Com	1.6828	17.3847	1.3134	-16.0354	9.7986	1.3175
Siemens Ltd.	29.1010	17.2688	0.8777	9.1430	13.9991	0.9312
Spanco Ltd.	24.6897	19.7721	0.8685	- 3.2361	16.6686	0.8696
Bharti Airtel	37.0282	20.4043	0.8457	25.1928	18.9815	0.8384
G T L Ltd	24.2592	12.6901	1.2593	3.6582	8.4636	1.2671
Vital Com Ltd	13.0955	13.8344	0.7725	-39.0651	11.6213	0.7773
Dish T V	- 9.3922	14.0619	1.0190	-31.8862	8.7112	1.0467
HFCL Infotel	7.6994	9.0984	0.7578	-21.5340	6.3023	0.7634
Average	**13.0522**	**15.8847**	**0.9654**	**- 9.5982**	**11.9319**	**0.9757**
T-test	**0.5354**			**0.0029**		

In telecom sector, most of the companies are having positive average returns, except Idea Cellular and Dish T V India Ltd. The t-test reveals that there is no significant difference between the security return and required return.

Average required return and average log required return of telecom sector are 15.88 and 11.93. The above table reveals that all companies' required return and average log required return are almost similar to average return.

The beta value of all the companies is below 1.00 but two companies showed it to be more than one which is the indication that these companies stocks are very aggressive in nature. The companies with the aggressive stocks were**:** Reliance Communication and Dish TV India Ltd. Overall beta of the sector is 0.96, which means Telecom Sector is almost aggressive in nature.

7. Findings

The study is based on the performance of IT, Pharmaceutical and Telecom Sector by taking into consideration return, required return and beta. The study reveals the following findings.

1. It is clear from the above result that IT Sector performs on par with the market.

2. The study also reveals that Pharmaceutical Sector's average return is a maximum of 26.32% compare to IT and Telecom Sector (i.e. 21.22% and 13.05%).

3. The findings indicate that, there is insignificant difference between actual return and required return as well as log return and log required return in each sector and company.

4. In Telecom Sector actual return and required return are closely related.

5. The finding of the study reveals that high risk securities earn high return.

6. IT companies' return are more relevant with the market return.

8. Conclusion

CAPM says that the expected return of a security equals the rate on a risk-free security plus a risk premium. If this expected return does not meet or beat our required return, the investment should not be undertaken, but in this study expected return meets required return. Study also reveals

high risk security which yields high return. The study shows that all three sectors perform on par with the market there is insignificant difference between actual return and required return.

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