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Validity of Capital Asset Pricing Model (CAPM): Empirical Evidence from Indian Stock Market

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Abstract – The present study examines the Capital Asset Pricing Model (CAPM) for the Indian stock market from 30 companies of the Nifty Index listed on the National Stock Exchange for the period 1st April 2019 to 31st March 2020 with the help of Black Jensen Scholes Methodology. The findings of this study do not confirm that the basic result of the theory is the time series regression of additional portfolio returns relative to higher levels of returns. The model explains, however, the higher returns and thus supports the linear structure of the CAPM equation. The theory for intercept is that it should be equal to zero and the slope should be equal to the additional return on the market portfolio. The study concludes that Capital Asset Pricing Model holds partially valid in Indian Stock Market.

Keywords – CAPM, National Stock Exchange (NSE), Black Jensen Scholes Methodology

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1. INTRODUCTION

The capital market plays an important role in the development of the economy and is an integral part of the economic system. In the capital market, the way in which securities are priced is a major issue and has long attracted the attention of researchers. The risk-return relationship plays a central role in the price of securities and as a result helps in making the right investment decision.

Investment decisions are primarily guided by the risk-return relationship of the securities. Over the past few decades, economists, economists and statisticians have been developing models of stock price behaviour. Based on the risk-return characteristics of the securities, a rational investor will always expect a premium on each additional risk taken. Thus, investors will demand higher returns for risky assets. The theory of asset prices has been the subject of much debate over the past few decades. Many of the proposed theories and their respective models are primarily involved in mapping the relationship between risk and return. In general, there are two risk factors associated with a portfolio. One is systemic risk and the other is systemic risk. In the development of the Capital Asset Pricing Model, the following assumptions have been considered:

- All investors are risk-averse for a single period and prefer to make maximum use of the usefulness of the terminal assets.
- They can select the portfolio only on the basis of mean and variation,
- no taxes or transaction costs,
- all investors have a common view on the parameters of the distribution of the combined potential of all security returns, and
- All investors can borrow and lend at a given risk-less interest rate.

Nearly five decades later, CAPM is still widely used in applications, such as estimating capital costs for companies and evaluating the performance of a managed portfolio. It is the focus of many investments and financial market courses. Indeed, this is the only asset value model taught in these courses. There is still a great deal of discussion in the finance literature on the experiential validity of CAPM.

Some of the research studies back the testing of CAPM and shows the results in the favour of the model which (K.M. and Shaji, 2018) leads to the conclusion that portfolio combination may be of importance in price and should be established with more empirical tests. In nutshell, the results show that CAPM has not been definitively verify during the study period and does not mean that the data rejects CAPM outright. Current studies have shown that beta can explain the difference in

portfolio returns when using the same weighted portfolio, and it has been found that, in most cases, returns on portfolios increase with beta growth, but we do not see this trend in all portfolios.

2. REVIEW OF LITERATURE

Choudhary and Choudhary (2010) observed in their study titled 'Testing Capital Asset Pricing Model: Empirical Evidences from Indian Equity Market' that the CAPM estimate for the intercept is that it should be equal to zero and the slope should be equal to the additional return on the market portfolio. The findings of the study contradict the above hypothesis and suggest evidence against CAPM. The inclusion of the square of the beta coefficient to test the nonlinearity in the relationship between the return and the beta indicates that the findings are hypothetical and the expected return beta relationships are linear. In addition, tests conducted to check whether CAPM captures all the important aspects of reality, including the residual variation of the stock, indicate that the residual risk has no effect on the expected return on the portfolio. The results of the tests performed on the sample data for the period January 1996 to December 2009 do not clearly reflect CAPM. In light of the above findings, it can be concluded that the beta is not sufficient to determine the expected return on securities/ portfolio. Bajpai and Sharma (2015) examined and concluded in their research paper 'An Empirical Testing of Capital Asset Pricing Model in India' that CAPM can be estimated by removing the intercept term from the second phase of the model, which is a cross sectional regression equation. With the help of this limited model CAPM works much better than the limited model. The use of the intercept term in the second phase of CAPM is a complete failure of the model in the context of the Indian equity market, while the removal of the intercept term provides a new model that further clarifies the risk-return relationship in the Indian equity market 62% of the time. The high value of the adjusted R square in the case of a limited model supports the fact that systematic risk is the only factor that helps to explain the process of creating a return on risky assets. Nyangara, Ndlovu and Tyavambiza (2016) concluded in their research paper 'An Empirical Test of the Validity of the Capital Asset Pricing Model on the Zimbabwe Stock Exchange' that using cross-sectional stock returns on 31 stocks listed on the ZSE between March 2009 and February 2014, we have shown that beta is an important factor in explaining average monthly stock returns, although explanatory power decreases significantly after the first 6 months estimated horizon. We failed to find the effect of any size on the average return, but instead found some significant negative liquidity and repulsive effects. Given the testing criteria for CAPM used in the current literature, we reject CAPM as a sufficient model to explain the average return on ZAP. The primary reason is that there are significant fluidity and repulsive effects on the same range that gives the beta the greatest explanatory power, CAPM because it performs very poorly on the horizon outside the optimal range of 3-6 months. Furthermore, we refrain from policies based on the existence of a premium of size on the ZSE. Instead, investors may consider neglected and negative skewed stocks, albeit on the right horizon. Shetty and D'Souza (2019) examined in their study 'An Empirical Examination of the CAPM on NSE SENSEX Stocks' that CAPM is a widely used technique for finding stock returns based on the risk characteristics of shares. Numerous researchers have researched the applicability of CAPM and found a positive relationship between the sample data and the CAPM model. But this study did not qualify CAPM for 30 BSE stocks for the period 1st January 2009 to 31st December 2018. The six portfolio companies in this study are a mixture of overvalued and undervalued stocks, and the seven grouped portfolios are purely portfolio low value stocks. Bajaj Finance Limited, which is a financial services portfolio, is performing better than other portfolios and the least performing portfolio is ONGC. According to the analysis of this study, it is clear that beta stock returns alone will not cause prices to rise or fall on the contrary many other administrative factors may be equally responsible for the movement of stock prices.

3. RESEARCH OBJECTIVES

This research paper aims to achieve the following objectives:

- To study the experiential validity of the CAPM in Indian Stock Market.
- To study the relation between market return and portfolio return in Indian Stock Market.

4. RESEARCH METHODOLOGY

Research methodology comprises the plan which determines the tools, techniques, methods and procedures followed to collect, analyse and interpret the data to achieve the research objectives. The research design adopted for the present study is descriptive in nature.

Sample Selection & Data Collection

The sample for the study includes 1-year daily data of 30 companies of Nifty and Nifty Junior Stock Index, a comprehensive-based index, data study conducted for the period from 1st April 2019 to 31 March 2020 from CMIE and Reserve Bank of India (RBI). The process data of RBI's websites is taken from the base. This study treats the 91-day Treasury bill rate as a proxy for risk-free assets, better reflecting short-term changes in financial markets.

Black, Jensen, and Scholes (1972) presented CAPM's time series tests and systematically analysed the relationship between risk and return. The current study will also adopt a similar approach to the portfolio technique and use the time series regression of additional portfolio returns on additional market returns and also do a sectional regression in the form of risk premiums and will be expressed by the following equation. In the first stage, the beta (systematic risk) of personal securities is calculated and the beta coefficients of individual securities are calculated for the entire period and for the sub-period. A time series between daily percentage returns versus market returns is used to obtain the beta coefficient of each security in the regression pattern and the model is shown below.

$$R_{i,t} - R_{f,t} = \alpha + \beta_{i,t}(R_{m,t} - R_{f,t}) + \varepsilon_{i,t}$$

where,

R_{it} = rate of return on asset 'I' at 't' time

R_{ft} = free risk at t' time

R_{mt} = return rate on market portfolio at 't' time

B_{it} = beta stock of 'i'

E_{it} = random disturbance term in the regression equation at 't' time

The portfolio beta is then calculated using the following model…

$$r_{pt} = \alpha_p + \beta_p r_{mt} + e_{pt}$$

where,

r_{pt}= excess average portfolio returns on 't' time

β_p= beta estimated portfolio

e_{pt} = error term in the regression equation at 't' time

Portfolio returns versus portfolio beta to predict the former post-security market line for each test period. Is the model…

$$r_{pt} = \alpha_p + \beta_p r_{mt} + e_{pr}$$

where,

r_{pt} = excess average portfolio returns at 't' time

r_{mt} = excess average return on market portfolio at 't' time

e_{pr} = random disturbance term in the regression equation at 't' time

The CNX 500 Index is considered a proxy for the market portfolio. If CAPM holds, we will observe that α_p should be equal to zero and SML, the slope coefficient of β_p will be statistically significant. We used the following equation to examine the disparity between total portfolio returns and beta:

$$r_p = \gamma_0 + \gamma_1\beta_p + \gamma_2\beta_p^2 + e_p$$

5. DATA ANALYSIS & INTERPRETATION

This section calculates the beta (systematic risk) of personal securities and the beta coefficients of individual securities are calculated for the entire period thereafter and for the sub-period. A time series between daily percentage returns versus market returns is used to obtain the beta coefficient of each security in the regression pattern. The following table shows the calculation.

Table 1: Description of Alpha, Std. Error and T Value for 30 stocks of Nifty and Nifty Junior in Indian Stock Market

Sr. No.	Alpha	Std. Error	'T' Value
1.	0.006854	0.007153	0.768429
2.	0.005047	0.006847	0.694872
3.	0.004875	0.005684	0.612843
4.	0.004149	0.004872	0.536971
5.	0.003084	0.00682	0.484237
6.	0.018593	0.006147	3.007429
7.	0.016418	0.011381	1.688471
8.	0.131951	0.007793	1.710954
9.	0.004284	0.008170	0.469273
10.	0.004037	0.013286	0.35810
11.	0.001684	0.094182	0.174537
12.	0.00349	0.009047	0.406218
13.	0.001573	0.007842	0.217394
14.	0.003957	0.009718	0.417430
15.	0.003719	0.007149	0.548273
16.	0.013861	0.135794	0.975841
17.	0.010875	0.00792	1.496146
18.	-0.01739	0.009361	-1.8247
19.	0.007681	0.007938	0.957028
20.	0.01427	0.006924	1.195819
21.	0.005883	0.006927	0.937410
22.	-0.00943	0.008019	-1.06381
23.	0.010746	0.007581	1.482737
24.	0.019948	0.006618	2.842973
25.	0.011071	0.00793	1.56286
26.	0.000759	0.006381	0.148476
27.	0.006757	0.007973	0.768482
28.	0.001052	0.007908	0.137451
29	0.000281	0.009154	0.01715
30.	0.142840	0.01171	1.704829

Interpretation: It I assumed that the intercept or alpha value will not be significantly different from the 0 and Capital Asset Pricing Model holds its validity in the Indian Stock market but empirical findings show that only 5 stocks out of 30 stocks have their 't' value higher than 1.67 which indicates insignificant outcome for the majority of selected stocks. This depicts that stock returns have been described adequately by excess market return or risk premium as assumed by CAPM.

Table 2: Description of CAPM for Portfolio of Alpha

Portfolio	Alpha	Std. Error	'T' Value	Beta	Std. Error	'T' Value
P1	0.000947	0.003141	0.185932	0.869141	0.041821	21.14213
P2	-0.00418	0.003309	-0.88542	0.918317	0.043018	22.84721
P3	-0.00642	0.003684	-1.40297	0.904392	0.045173	21.54825
P4	-0.00473	0.003418	-0.86718	0.954127	0.044820	22.72105
P5	0.003418	0.003172	1.138472	0.96471	0.039497	25.17652

Interpretation: When the analysis was repeated with 5 portfolios, the results again shows that alpha value is not significant while as the 't' value is significant for all the 5 portfolios. Whereas the market risk premium explains the security returns whereas the portfolio returns and excess return does not show relationship and provide evidence against the Capital Asset Pricing Model in Indian Stock Market.

Table 3: Description of Excess Return of Portfolio

Portfolio	Excess Return
P1	0.008694
P2	0.006841
P3	0.004937
P4	0.006572
P5	0.013841

Interpretation: This study attempts to test the empirical validity of CAPM using a portfolio. The theory is that through diversification, one can strategically reduce risk by creating a balanced portfolio and allocating funds available across multiple securities. Further, this test will help us to compare the results with our study with the same set of data and also to see if the number of securities in the portfolio has any effect on measuring the efficiency and validity of CAPM.

The intercept should not be significantly different from zero and the retrograde slope coefficient in India should be critical for CAPM to be valid. The above tables show that only a few of the 30 stocks that are subject to empirical testing show intercept terms with a T-value greater than 1.97 that indicate statistical significance. The intercept term is not important for the rest of the stock. This indicates that the adequate description of the security return is provided by CAPM through Market Risk Premium.

While examining the relationship between market return and portfolio return in Indian Stock Market, we do not find evidence in favour of CAPM - which assumes that high beta (risk) portfolios are entitled to high returns and securities market line has a positive slope and high beta portfolios provide higher returns.

For five portfolios we replicate the same analysis and the result shown in the above table it shows the result that the term of intercept is for 4 portfolios only which are an important portfolio. While in other cases the intercept term is not significant. The regression slope coefficient for market risk premium is significant for all ten portfolios making market risk premium an important variable in explaining portfolio returns in India.

6. FINDINGS & CONCLUSION

One wonders what drives the returns in today's global capital markets. Also, the models may have come and have a variety of multifactor that have proven to be good models of property prices after the traditional CAPM.

Jensen's alpha is a regression barrier and measures the abnormal returns of a portfolio that correlate the returns on assets with the returns on the market portfolio. If CAPM holds in general, the correlation of asset return with only market return can provide a sufficient explanation of the risk premium, such that the alpha should be zero. For this reason, the hypothesis is tested with null hypothesis where alpha is zero.

It was further found that the trials in the sub-period were also consistent with the above tables and indicated evidence in support of CAPM but did not provide conclusive evidence or not fully support CAPM in all trials. This leads to the conclusion that some of the results are inconsistent with the theory and are therefore contrary to CAPM.

In the present study, it was found that there is no linear relationship between portfolio returns and beta. One of the new revised pricing models is the Arbitrage Pricing model and at the time of its launch it was believed that it would solve theoretical and empirical problems related to CAPM. However, in the case of India the regression analysis shows that the former post-macro-economic factors have a limited impact on stock returns and here too there is a market risk premium which mostly explains the portfolio returns.

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