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An Empirical Study of Capital Asset Pricing Model Performance: NIFTY 50-Perspective

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Abstract **-- A fundamental component of financial theory, the Capital Asset Pricing Model (CAPM) provides a framework for calculating expected returns based on market risk. However, because of market inefficiencies, volatility, and changing investment behaviours, its application in developing nations like India is still up for question. In the majority of individual decision-making processes, risk and return analysis is crucial. This paper contrasts return estimation using the standard model and the CAPM model and critically investigates the applicability of the CAPM framework in the Indian capital market.**

In addition to the systematic risk factor, there are a number of other elements that could be the subject of future research, such as the Fama French three factor model, capital structure influence, and multivariant factors.

Keywords-- **Beta, CAPM, Expected Return, Nifty-50, Return, Risk, Risk free**

I. INTRODUCTION

A financial model called the Capital Asset Pricing Model (CAPM) is used to calculate an investment's expected return based on systematic risk. Building on Harry Markowitz's portfolio theory, William Sharpe, John Lintner, and Jan Mossin developed it.

The fundamental tenet of CAPM is that investors must receive payment in two ways:

The risk-free rate (Rf) is a representation of the time value of money.

The second is the risk premium, which is calculated using beta (β) as compensation for taking on more risk.

Although CAPM is one of the most fundamental models in finance, there is much disagreement about its practicality, particularly in developing nations like India. This creates a great deal of opportunity for comparative model testing and empirical validation.

In India, analysts and researchers employ CAPM for:

1) Equity valuation to determine intrinsic values for investment choices.
2) Portfolio optimisation: determining whether the return on a stock is worth the risk.
3) Estimating the cost of equity for corporate finance decisions (WACC).
4) Mutual fund performance: determining whether a fund has outpaced returns expected by the CAPM (using Jensen's Alpha).
5) Sector analysis: comprehending how various industries (such as IT and pharmaceuticals) react to changes in the market.

This article compares return estimation using the standard model and the CAPM model and critically evaluates the applicability of the CAPM framework in the Indian capital market.

The empirical testing of the Capital Asset Pricing Model (CAPM) in the Indian equity market is the main objective of this work. The data is daily returns for ten years, from October 2014 to October 2024. A financial model called the Capital Asset Pricing Model (CAPM) explains how systematic risk and expected return relate to investments, especially equities. It assists investors in figuring out the necessary rate of return based on the asset's risk.

In order to help investors make well-informed investment decisions, the Capital Asset Pricing Model (CAPM) is frequently used in finance to price risky securities and predict projected returns. By contrasting an investment's predicted return with its risk level (beta), the CAPM helps investors determine if the risk is worthwhile.

Tools utilised in this study to determine its goals:

- The mean return
- Return is equal to (closing price - opening price)/(opening price) * 100, and the average return is equal to (Return/N).
- A capital asset pricing methodology to determine the anticipated return

Ri is equal to Rf + β (Rm – Rf).

Where

Ri stands for expected return on investment.

Rf: Government T-bills are risk-free.

Beta = Risk measure: How hazardous is the investment in relation to the market?

Rm is the market's anticipated return. Nifty fifty.

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II. Literature Review

- Bangur (2024). The CAPM: Exploring its Empirical Evidence on NSE Nifty—From the Period 2008 to 2023. SDMIMD Journal of Management, 15(2), 95–110.
  Examining the Nifty 50 index from April 2008 to March 2023, this study identified a positive but non-significant relationship between average returns and systematic risk. Additionally, 38% of the securities exhibited significant non-zero alphas, indicating that CAPM does not operate perfectly in the Indian market.
- Palraj (2024). A study on Capital Asset Pricing Model with reference to BSE-500. International Journal of Management, 11(1), 45–56.
  This study examined CAPM using monthly stock returns from four companies listed on the BSE-500 from 2018 to 2023. The findings validated CAPM's prediction that higher risk (beta) is associated with higher returns, with the intercept term equalling zero and the slope equalling the excess returns on the market portfolio.
- Bajpai (2015). An empirical testing of Capital Asset Pricing Model in India. Procedia - Social and Behavioral Sciences, 189, 259–265.
  Utilizing rolling regression over a decade (2004–2013), this study concluded that CAPM is significant in the Indian equity market, with the developed model outperforming the traditional one.
- Dhankar (2005). Application of CAPM in the Indian stock market: A comprehensive reassessment. Journal of Emerging Market Finance, 4(2), 157–183.
  This research reevaluated CAPM's applicability in India and found that the model's predictions did not align well with actual market returns, suggesting the need for alternative asset pricing models.
- Basu(2010). An empirical test of CAPM—the case of Indian stock market. Global Business Review, 11(2), 209–220.
  This study analysed 10 portfolios comprising 50 stocks from January 2003 to February 2008. The findings indicated a negative relationship between beta and excess returns, suggesting that CAPM does not hold in the Indian context.
- Joshi (2020) Testing Capital Asset Pricing Model: Empirical Evidences from Indian Equity Market. Journal of Financial Economics, 8(2), 127–138.
  Analysing data from 2005 to 2015, this study found inconsistencies with CAPM predictions, particularly regarding the linear relationship between beta and expected returns, suggesting the need for alternative models in the Indian context.

III. Identified Gap

No thorough study has investigated CAPM utilising higher-frequency data or event-window regressions on the Nifty 50, despite the fact that monthly returns and static alpha estimates are widely used. Furthermore, sectoral mispricing patterns and rolling-window CAPM research after 2013 are still unexplored. Lastly, even if some stocks exhibit notable alpha, neither the performance of CAPM in comparison to multifactor models like Fama French nor the temporal persistence of such mispricing have been assessed in the Indian context.

IV. Objective Of The Study

The primary objective of this research is to examine the applicability of the Capital Asset Pricing Model (CAPM) in the Indian stock market, with specific reference to Nifty fifty companies.

1) To understand the significance of the CAPM model in the Indian Stock Market.
2) To empirically Compare actual returns with CAPM-predicted returns of Nifty fifty companies.
3) To know how many Underpriced and Overpriced stocks of Nifty 50.

OBJECTIVE:1 Significance of capital asset pricing model in Indian stock market.

A key concept in financial economics, the Capital Asset Pricing Model (CAPM) links asset returns to systematic market risk in order to explain the relationship between risk and expected return. The approach is predicated on the idea that while unsystematic risk can be reduced through diversification, investors are only reimbursed for bearing non-diversifiable risk, as indicated by beta (β). Because of its conceptual clarity and practical applicability, CAPM remains relevant in rising markets like India even though it was first created for efficient and mature markets. The CAPM is a benchmark model used in the Indian stock market to assess asset pricing efficiency and comprehend risk-return dynamics.

Even with market flaws such information asymmetry, liquidity limitations, and behavioural biases, analysts, portfolio managers, and corporate finance experts continue to employ CAPM extensively.

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Its importance stems from both its capacity to calculate predicted returns and its function as a benchmark by which different asset pricing models are assessed. In India, corporate financial decision-making heavily relies on CAPM, especially when assessing the cost of equity capital. The needed rate of return for equity investors, which is a crucial component in calculating the Weighted Average Cost of Capital (WACC), is frequently calculated by businesses using the CAPM.

This has a direct impact on strategic investment choices, project appraisal, capital budgeting, and firm value. CAPM is frequently used as a baseline model, reinforced with additional risk premiums to reflect firm-specific and market-specific hazards, even when its assumptions are acknowledged as restricted.

CAPM offers a methodical way to evaluate whether shares are properly priced from an investing standpoint. Investors can determine if securities are overvalued or underpriced by comparing actual stock returns with CAPM-predicted returns. In the Indian market, where sectoral discrepancies and valuation irregularities are common, this application is especially pertinent. Pricing inefficiencies are brought to light by deviations from CAPM forecasts, which also support the model's value as an analytical benchmark rather than a final pricing instrument. In India, CAPM is also widely used to assess the performance of mutual funds and portfolios. Performance metrics like Jensen's Alpha, which are based on the CAPM paradigm, evaluate if portfolio managers provide returns that are higher than what market risk justifies.

CAPM-based performance evaluation is still a crucial instrument for scholarly research and regulatory evaluation in light of the mutual fund industry's explosive growth in India and the rise in retail investor engagement. Empirical research on the Indian stock market, however, has yielded conflicting results about the applicability of CAPM.

Because of the impact of extra risk variables, market inefficiencies, and macroeconomic volatility, the relationship between beta and realised returns is frequently weak or inconsistent. These drawbacks highlight CAPM's function as a fundamental model that inspires the creation and evaluation of multifactor asset pricing frameworks rather than lessening its significance.

In summary, the Capital Asset Pricing Model's importance in the Indian stock market goes beyond its empirical precision. CAPM continues to be an essential theoretical standard, a useful tool for making decisions, and a starting point for more complex asset pricing studies. Even though it might not adequately represent the intricacies of return behaviour in the Indian market, CAPM nonetheless offers insightful information about risk-return connections and is an essential point of reference for both academic study and financial practice.

OBJECTIVE 2. To empirically Compare actual returns with CAPM-predicted returns of Nifty fifty companies.

Hypothesis

Null Hypothesis (H_0): There is no significant difference between actual returns and CAPM-predicted returns.

Alternative Hypothesis (H_1): There is a significant difference between actual returns and CAPM-predicted returns.

Out of 49 observations 9 companies are underpriced and 40 companies are over priced

For the study variables are:

Dependent variable (VARIABLE 1)

1. *Actual stock return*

Independent variable (VARIABLE 2)

1. *CAPM Returns*

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V. Data Analysis And Interpretation

Test the reliability of CAPM using PAIRED SAMPLE T TEST analysis over a ten-year period (2014–2024)

Particulars	*Variable 1*	*Variable 2*
Mean	18.95064521	12.24865534
Variance	73.31084781	2.142054586
Observations	49	49
Pearson Correlation	0.38269748	
Hypothesized Mean Difference	0	
df	48	
t Stat	5.780776889	
P(T<=t) one-tail	2.70559E-07	
t Critical one-tail	1.677224196	
P(T<=t) two-tail	5.41119E-07	
t Critical two-tail	2.010634758	

Interpretation of Results

A paired t-test was conducted to compare the Actual Returns (Variable 1) and the CAPM Returns (Variable 2) for 49 observations.

✓*1. Mean Comparison*

The mean of actual returns is 18.95

The mean of CAPM returns is 12.25

☞ This indicates that the actual returns are, on average, 6.70 units higher than the returns predicted by the CAPM model.

✓*2. Test of Significance observations:*

t-statistic = 5.78

Degrees of freedom (df) = 48

p-value (two-tail) = 0.0000005411(5.41119E-07) Which is compared with the standard significance level of 0.05.

Critical t-value (two-tail) = 2.01

The t-statistic obtained was 5.78, with 48 degrees of freedom. The corresponding p-value (two-tailed) was 0.0000005411, which is significantly lower than the standard significance level of 0.05.

☞Since the t-statistic > t-critical value, (REFTABLE) & p-value < 0.05, we reject the null hypothesis.

Statistical Analysis and Interpretation:

A paired sample t-test was used to compare the actual returns with the CAPM-predicted returns over 49 observations in order to assess how well the Capital Asset Pricing Model (CAPM) predicts stock returns.

Testing Hypotheses:

1. Null Hypothesis (H_0): Actual returns and CAPM-predicted returns do not differ significantly.

2. Alternative Hypothesis (H_1): The actual returns and the returns predicted by the CAPM differ significantly. We determine that there is a statistically significant difference between actual returns and returns projected by the CAPM, rejecting the null hypothesis.

OBJECTIVE 3. To know how many Underpriced and Overpriced stocks of Nifty 50.

The NIFTY FIFTY companies which are underpriced

Tata Motors Limited, SBI Life Insurance Company Limited, Hero Moto Corp Limited, HDFC Life Insurance Company Limited, Oil & Natural Gas Corpn Limited, Coal India Limited, ITC LIMITED and INDUSIND BANK LIMITED

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The NIFTY FIFTY companies which are overpriced

Bajaj Finance Limited, Axis Bank Limited, Asian Paints Limited, Apollo Hospitals Enterprise Limited, Adani Enterprises Limited, Wipro Limited, Ultra tech Cement Limited, Trent Limited, Titan Company Limited, Tech Mahindra Limited, Tata Steel Limited, Tata Consumer Products Limited, Tata Consultancy Services Limited, Sun Pharmaceuticals Industries, Shriram Finance Limited, State Bank Of India, Reliance Industries Limited', Power Grid Corporation Of India, ICICI Bank Limited, Hindalco Industries Limited, Grasim Industries Limited, Britannia Industries Limited, Bharat Petroleum Corporation, Bharat Electronics Limited, Bajaj FINSERV Limited, Bajaj Auto Limited, Adani Ports & Special Economic, Bharti Airtel Limited, Cipla Limited, Dr Eddys Lab Limited, Eicher Motors Limited, HCL Technologies Limited, HDFC Bank Limited Maruthi Suzuki Limited, Hul, JSW Steel Limited, Kotak Mahindra BK Larsen & Toubro Limited, Mahindra & Mahindra Limited, ICICI Infosys Limited

VI. Conclusion

Over the course of 10 years, from October 2014 to October 2024, this study set out to empirically investigate the application of the Capital Asset Pricing Model (CAPM) in the Indian stock market with particular reference to Nifty 50 companies. Assessing the importance of CAPM in the Indian context, comparing actual stock returns with CAPM-predicted returns, and identifying overpriced and underpriced equities based on CAPM valuation were the main goals. The study offers significant insights into the applicability and constraints of CAPM in an emerging market context by utilising secondary data and statistical techniques such average return analysis, CAPM estimate, and a paired sample t-test.

The second goal was to compare the actual returns of a subset of Nifty 50 businesses with the returns projected by the CAPM. The two sets of returns differ statistically significantly, according to the paired sample t-test results. The null hypothesis was rejected since the computed t-statistic was more than the critical value and the p-value was considerably less than the selected level of significance. This indicates that systematic risk alone is insufficient to explain stock returns in the Indian market throughout the study period, as it reveals that CAPM-predicted returns diverge considerably from actual market returns. The alternative hypothesis that there is a substantial discrepancy between actual and CAPM-predicted returns is therefore accepted.

In order to achieve the third goal, the study compared actual returns with CAPM anticipated returns to identify companies that are overpriced and underpriced. It was discovered that most of the Nifty 50 companies were overpriced, with a lesser percentage being underpriced. This result underscores the limits of CAPM in accurately reflecting intrinsic stock prices and suggests possible mispricing in the market. In addition to systemic market risk, the existence of such mispricing indicates the impact of other risk variables, market sentiment, and firm-specific traits. Overall, the study's conclusions indicate that although CAPM is still a helpful theoretical framework and a place to start when valuing assets and making investment decisions, it is unable to adequately account for return fluctuations in the Indian stock market.

The observed mispricing patterns and the null hypothesis' rejection show that asset pricing models must take into account other elements like size, value, liquidity, and macroeconomic variables. For more precise return estimation, investors, analysts, and corporate finance managers should use CAPM cautiously and supplement it with multifactor models. In order to have a deeper understanding of asset pricing behaviour in the Indian capital market, the study also creates opportunities for future research utilising sector-wise evaluation, rolling beta analysis, and alternative models.

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