
**THE APPLICATION OF THE CAPITAL ASSET PRICING MODEL (CAPM): INDIAN CAPITAL
MARKET PERSPECTIVE**

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Abstract:

The focus of this paper is the capital asset pricing model (CAPM), with a specific emphasis on two of its main components, namely the risk-free rate and beta. The aim of this research paper is to know individual security returns and the risk-return relationship. Additional objective of the study is to know whether securities are underpriced or overpriced. The data that used in this research paper is the daily closing prices of 50 companies listed on the National Stock Exchange (NSE) which comprise the Nifty Index would be considered for the period July 2012 to June 2014. For to achieve those objectives this model i.e. Asset pricing, CAPM and single-factor has been used. The result shows that ACC Ltd, Ambuja Cement Ltd, Bharti Airtel Ltd, IDFC Ltd, NTPC Ltd, and TATA Power Co.Ltd securities which continuously overvalued While Axis Bank Ltd., HCL Technologies Ltd., Housing Development Finance Corporation Ltd., Lupin Ltd., Mahindra & Mahindra Ltd., Maruti Suzuki India Ltd., Tata Consultancy Services Ltd., Tata Motors Ltd., Tech Mahindra Ltd. And UltraTech Cement Ltd. securities which continuously Undervalued because estimated return are Higher than its theoretical or expected return. This paper would be of considerable relevance and useful to the various investors in selection of stocks for their portfolios.

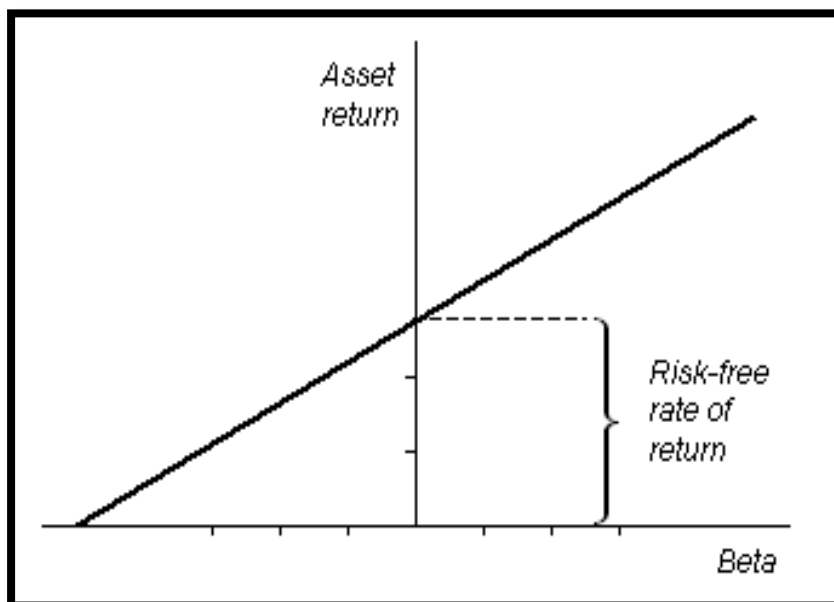
Keyword: Risk – Return Relationship, Overvalued, Undervalued and Capital Asset Pricing model

INTRODUCTION:

In finance, the capital asset pricing model (CAPM) is used to determine a theoretically appropriate required rate of return of an asset, if that asset is to be added to an already well-diversified portfolio, given that asset's non-diversifiable risk. The model takes into account the asset's sensitivity to non-diversifiable risk (also known as systematic risk or market risk), often represented by the quantity beta (β) in the financial industry, as well as the expected return of the market and the expected return of a theoretical risk-free asset. CAPM "suggests that an investor's cost of equity capital is determined by beta." An extension to the CAPM is the dual-beta model, which differentiates downside beta from upside beta.

The CAPM was introduced by Jack Treynor (1961, 1962), William Sharpe (1964), John Lintner (1965a,b) and Jan Mossin (1966) independently, building on the earlier work of Harry Markowitz on diversification and modern portfolio theory. Sharpe, Markowitz and Merton Miller jointly received the Nobel Memorial Prize in Economic for this contribution to the field of financial economics.

Because of its simplicity and despite more modern approaches to asset pricing and portfolio selection (like Arbitrage pricing theory and Merton's portfolio problem, respectively), CAPM still remains popular.



The CAPM is a model for pricing an individual security or portfolio. For individual securities, we make use of the security market line (SML) and its relation to expected return and systematic risk (beta) to show how the market must price individual securities in relation to their security risk class. The SML enables us to calculate the reward-to-risk ratio for any security in relation to that of the overall market. Therefore, when the expected rate of return for any security is deflated by its beta coefficient, the reward-to-risk ratio for any individual security in the market is equal to the market reward-to-risk ratio, thus:

$$\frac{E(R_i) - R_f}{\beta_i} = E(R_m) - R_f$$

The market reward-to-risk ratio is effectively the market risk premium and by rearranging the above equation and solving for E (Ri), we obtain the Capital Asset Pricing Model (CAPM).

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f)$$

Where:

- $E(R_i)$ is the expected return on the capital asset
- R_f is the risk-free rate of interest such as interest arising from government bonds
- β_i (the beta) is the sensitivity of the expected excess asset returns to the expected excess

market returns, or also

$$\beta_i = \frac{\text{Cov}(R_i, R_m)}{\text{Var}(R_m)}$$

- $E(R_m)$ is the expected return of the market
- $E(R_m) - R_f$ sometimes known as the market premium (the difference between the expected market rate of return and the risk-free rate of return).
- $E(R_i) - R_f$ is also known as the risk premium

Restated, in terms of risk premium, we find that:

$$E(R_i) - R_f = \beta_i(E(R_m) - R_f)$$

This states that the individual risk premium equals the market premium time's β .

Note 1: the expected market rate of return is usually estimated by measuring the Geometric Average of the historical returns on a market portfolio (CNX NIFTY).

Note 2: the risk free rate of return used for determining the risk premium is usually the arithmetic average of historical risk free rates of return and not the current risk free rate of return.

Literature Review:

Don U.A.Galagedera "A Review of Capital Asset Pricing Models" with objective of to know individual security returns and the risk-return relationship. He used single-factor and multifactor models extended forms of the Capital Asset Pricing Model (CAPM) with higher order co-moments and asset pricing models conditional on time-varying volatility. In His review he found that when the market return in excess of the risk-free return is negative, an inverse relationship between beta and portfolio returns is expected. His test for a systematic conditional relationship between the realised returns and the beta in an empirical investigation of US data revealed a positive risk premium in the up market and a negative risk premium in the down market

Theriou. N, Aggelidis. V, and Spiridis. T "Empirical Testing of Capital Asset Pricing Model" with objective of to know linear relation between risk and portfolio returns. Their studied period was July 1992 to the June 2001 with using the tools i.e. CAPM, beta, cross-section of returns, two-factor model. They tested the hypothesis from the time series test that the intercept should be significantly equal to zero and the hypothesis from the cross-sectional tests that the intercept should be equal to zero and the beta coefficient should be equal to the mean excess return on the market. They conclude that the traditional CAPM was not verified in the ASE for the period between the 1992 to 2001. The inferences were quite different when testing Black's two-factor model which was not verified for all the periods of the analysis.

Michael C. Jensen & Myron Scholes (1972) "The Capital Asset Pricing Model: Some Empirical Tests" with aim to developed portfolio evaluation models and to measure the relation between the expected risk premiums on individual assets and their systematic risk. Their studied they used models like capital asset pricing, measurements, Cross-sectional Tests, Two-Factor Model, aggregation problem, where their evidence presented that the expected excess return on an asset was not strictly proportional to its Beta.

Kapil Choudhary & Sakshi Choudhary (2010) "Testing Capital Asset Pricing Model: Empirical Evidences from Indian Equity Market" with examine the non linearity of the relationship between return and betas. Their studied period between January 1996 to December 2009 with using methods i.e. CAPM, portfolio returns, beta, risk free rate, systematic risk, where they investigates whether the CAPM adequately captures all-important determinants of returns including the residual variance of stocks. Their results exhibit that residual risk has no effect on the expected returns of portfolios.

W. S. Nel (2011) "The application of the Capital Asset Pricing Model (CAPM): A South African perspective" with a specific emphasis on two of its main components, namely the risk-free rate and beta. The aim of the paper is to investigate how well valuation theory regarding the CAPM in particular, as advocated by academia, is aligned with the CAPM and alternative models that leading financial analysts and corporate financiers apply in practice. His Studied found that both academia and investment practitioners favor the CAPM, they disagreed significantly with regard to the components of the CAPM and the use of alternative models.

Sylvester Jarlee (2007) "A Test of the Capital Asset Pricing Model: Studying Stocks On The Stockholm Stock Exchange". He want to examine that If higher beta yields higher expected return, If the intercept equals zero/average risk-free rate and slope of SML equals the average risk premium and If there exist linearity between the stock beta and the expected return. His studied period between January 2001 to December 2006 with using tools like CAPM, Time-series test, Cross-sectional test. His investigation found that the empirical investigations carried out during the study do not fully hold up with CAPM. Also his data did not provide evidence that higher beta yields higher return while the slope of the security market line is negative and downwards sloping. His data provided a difference between average risk free rate, risk premium and their estimated values. However, a linear relationship between beta and return was established.

Tom A. Fearnley (2002) "Estimation of an International Capital Asset Pricing Model with Stocks and Government Bonds" with objectives of to investigates whether US, Japanese and European stock and government bond return indices. An additional objective is to explore the time variation of the price of market risk for a structural change in the prices of market and currency risk. His study with using model like International CAPM; Multivariate GARCH-in-Mean where he found that to be better for the stock markets than for the bond markets. Finally, out-of sample performance of the conditional optimal portfolio is measured relative to the market portfolio of stocks and bonds.

“The application of the Capital Asset Pricing Model (CAPM): An Indian Capital Market perspective” where the focus of this paper is the capital asset pricing model (CAPM), with a specific emphasis on two of its main components, namely the risk-free rate and beta. The aim of this research paper is to know individual security returns and the risk-return relationship. Additional objective of the study is to know whether securities are underpriced or overpriced. The data that used in this research paper is the daily closing prices of 50 companies listed on the National Stock Exchange (NSE) which comprise the Nifty Index would be considered for the period July 2012 to June 2014. For to achieve those objectives this model i.e. Asset pricing, CAPM, single-factor and multifactor models has been used. This paper would be of considerable relevance and useful to the various investors in selection of stocks for their portfolios.

Simon G. M. Koo and Ashley Olson “Capital Asset Pricing Model Revisited: Empirical Studies on Beta Risks and Return” with aim is that contribution of an asset to the variance of the market is the correct measure of the asset’s risk and the only systematic determinant of the asset’s return. Their Studies showed that firm size appeared to be a significant determinant of stock returns that there is no cross-sectional relationship between beta risk and return. In this study, they revisited the CAPM with empirical data from large firms. They gathered stock information for more than 288 publicly traded companies with market cap larger than 500 million dollars, price-earning-ratio less than 10, and a greater than 0 profitability for over a 1 year period. They also categorize risk factors of the stocks into three categories: low (beta around point five), market (beta about one), and high (beta about two). Covariance and correlation relations between the stocks as well as their risk factors were used to create optimal portfolios in hindsight. The goal is to test the hypothesis that the systematic risk of a portfolio as measured by its market model beta relevant measure of risk, and they would like to examine if beta is reliably related to the return of the portfolio conditional on the sign of the market risk premium, so they justified the use of market model betas estimated from historical price.

TL Reddy and RJ Thomson “The Capital-Asset Pricing Model: The Case of South Africa” where examines the capital-asset pricing model (CAPM) for the South African securities market. In this research paper they investigation quarterly total returns from 10 sectoral indices listed on the JSE Securities Exchange from 30 June 1995 to 30 June 2009, were used. The aim of this research paper is to explain excess return, and that the relation between expected return and beta is linear. Their studied with using models like Capital-asset pricing model; Beta; JSE Securities Exchange; Excess return where they found that on the assumption that the residuals of the return-generating function

are normally distributed, the CAPM could be rejected for certain periods, the use of the CAPM for long-term actuarial modeling in the South African market can be reasonably justified.

Jianhua Dai, Jian Hu and Songmin Lan "Research on capital asset pricing model empirical in China market" with purpose of to conduct a study of CAPM in China's Stock markets. The data that used in this research paper is Stocks data and combined data of Shanghai Stock Exchange were selected as research subjects in this paper. Their studied with using model like Capital Asset Pricing Model; Joint Detection; Listed Company where they conclude that CAPM model is essential in China's stock market. Thus, CAPM model can be applied in empirical analysis and theoretical study on the market as to promote the development of China's stock market.

Muhammad Asif Shamim (2014) "Validity of Capital Asset Pricing Model in Pakistan's Capital Market (Karachi Stock Exchange)" with aim of testing the validity of Capital Asset Pricing Model for Pakistani companies registered with Karachi Stock Exchange. The data that used in this research paper is one company has been selected from each of 22 different sectors registered in KSE for the period of 5 years running from 2008 to 2012. His studied with using this model i.e. capital assets pricing model, systematic risk, unsystematic risk, portfolio analysis, Pakistan where he found that CAPM is not the valid tool to estimate the return in Pakistani capital market, which implies that CAPM, is not valid for the companies.

OBJECTIVES:

The study has been conducted for examine the application of capital asset pricing model (CAPM), with a specific emphasis on two of its main components, namely the risk-free rate and beta the study has been conducted on individual securities listed in National Stock Exchange of India (NSE). The objectives of this study are:

- A. Risk -return analysis of individual securities listed in NSE.
- B. To know whether securities were underpriced or overpriced.

METHODOLOGY:

This is a descriptive study on the application of capital asset pricing model . The data taken for the study is secondary in nature. The data has been collected from the official website of National Stock Exchange (NSE), namely www.nse-india.com. The study is conducted with the financial data for the past two years from July 2012 to July 2014. The sample size of the study is limited to daily stock closing price of 50 companies which is listed in CNX NIFTY.

DATA ANALYSIS AND RESULT:

2012-2013			
Company Name	Estimated/ Average Return (R _i)	Exp. Return (E _i)	Remark
ACC Ltd.	-0.007	0.056	Overvalued
Ambuja Cements Ltd.	0.055	0.061	Overvalued
Asian Paints Ltd.	0.102	0.054	Undervalued
Axis Bank Ltd.	0.065	0.047	Undervalued
Bajaj Auto Ltd.	0.088	0.064	Undervalued
Bank of Baroda	-0.100	0.047	Overvalued
Bharat Heavy Electricals Ltd.	-0.094	0.043	Overvalued
Bharat Petroleum Corporation Ltd.	-0.321	0.068	Overvalued
Bharti Airtel Ltd.	-0.039	0.059	Overvalued
Cairn India Ltd.	-0.024	0.051	Overvalued
Cipla Ltd.	0.081	0.059	Undervalued
Coal India Ltd.	-0.078	0.067	Overvalued
DLF Ltd.	-0.077	0.076	Overvalued
Dr. Reddy's Laboratories Ltd.	0.133	0.073	Undervalued
GAIL (India) Ltd.	-0.049	0.041	Overvalued
Grasim Industries Ltd.	0.016	0.058	Overvalued
HCL Technologies Ltd.	0.201	0.049	Undervalued
HDFC Bank Ltd.	0.052	0.080	Overvalued
Hero MotoCorp Ltd.	-0.088	0.042	Overvalued
Hindalco Industries Ltd.	-0.095	0.062	Overvalued
Hindustan Unilever Ltd.	0.122	0.062	Undervalued
Housing Development Finance Corporation Ltd.	0.076	0.063	Undervalued
I T C Ltd.	0.119	0.071	Undervalued
ICICI Bank Ltd.	0.037	0.059	Overvalued
IDFC Ltd.	-0.042	0.079	Overvalued
IndusInd Bank Ltd.	0.153	0.059	Undervalued
Infosys Ltd.	0.006	0.060	Overvalued
Jindal Steel & Power Ltd.	-0.297	0.092	Overvalued
Kotak Mahindra Bank Ltd.	0.070	0.073	Overvalued
Larsen & Toubro Ltd.	0.003	0.074	Overvalued
Lupin Ltd.	0.170	0.074	Undervalued
Mahindra & Mahindra Ltd.	0.099	0.063	Undervalued
Maruti Suzuki India Ltd.	0.074	0.031	Undervalued
NMDC Ltd.	-0.254	0.045	Overvalued
NTPC Ltd.	-0.044	0.057	Overvalued
Oil & Natural Gas Corporation Ltd.	0.012	0.046	Overvalued
Power Grid Corporation of India Ltd.	-0.009	0.040	Overvalued

Punjab National Bank	-0.102	0.044	Overvalued
Reliance Industries Ltd.	0.088	0.045	Undervalued
Sesa Sterlite Ltd.	-0.071	0.070	Overvalued
State Bank of India	-0.056	0.063	Overvalued
Sun Pharmaceutical Industries Ltd.	0.233	0.052	Undervalued
Tata Consultancy Services Ltd.	0.123	0.029	Undervalued
Tata Motors Ltd.	0.092	0.043	Undervalued
Tata Power Co. Ltd.	-0.077	-0.036	Overvalued
Tata Steel Ltd.	-0.185	0.041	Overvalued
Tech Mahindra Ltd.	0.182	0.027	Undervalued
UltraTech Cement Ltd.	0.085	0.065	Undervalued
United Spirits Ltd.	0.524	0.099	Undervalued
Wipro Ltd.	-0.026	0.065	Overvalued

2013-2014			
Company Name	Estimated /Average Return (Ri)	Exp. Return (Ei)	Remark
ACC Ltd.	0.051	0.066	Overvalued
Ambuja Cements Ltd.	0.048	0.062	Overvalued
Asian Paints Ltd.	-0.851	0.140	Overvalued
Axis Bank Ltd.	0.165	0.093	Undervalued
Bajaj Auto Ltd.	0.073	0.082	Overvalued
Bank of Baroda	0.167	0.080	Undervalued
Bharat Heavy Electricals Ltd.	0.112	0.102	Undervalued
Bharat Petroleum Corporation Ltd.	0.217	0.067	Undervalued
Bharti Airtel Ltd.	0.065	0.066	Overvalued
Cairn India Ltd.	0.088	0.066	Undervalued
Cipla Ltd.	0.040	0.068	Overvalued
Coal India Ltd.	0.107	0.080	Undervalued
DLF Ltd.	0.069	0.068	Undervalued
Dr. Reddy's Laboratories Ltd.	0.049	0.068	Overvalued
GAIL (India) Ltd.	0.150	0.089	Undervalued
Grasim Industries Ltd.	0.073	0.049	Undervalued
HCL Technologies Ltd.	0.230	0.065	Undervalued
HDFC Bank Ltd.	0.178	0.087	Undervalued
Hero MotoCorp Ltd.	0.181	0.066	Undervalued
Hindalco Industries Ltd.	0.221	0.088	Undervalued
Hindustan Unilever Ltd.	0.022	0.088	Overvalued
Housing Development Finance Corporation Ltd.	0.084	0.048	Undervalued
I T C Ltd.	-0.012	0.061	Overvalued
ICICI Bank Ltd.	0.125	0.069	Undervalued

IDFC Ltd.	0.027	0.095	Overvalued
IndusInd Bank Ltd.	0.043	0.098	Overvalued
Infosys Ltd.	0.118	0.080	Undervalued
Jindal Steel & Power Ltd.	0.142	0.093	Undervalued
Kotak Mahindra Bank Ltd.	0.074	0.069	Undervalued
Larsen & Toubro Ltd.	0.068	0.063	Undervalued
Lupin Ltd.	0.084	0.081	Undervalued
Mahindra & Mahindra Ltd.	0.116	0.066	Undervalued
Maruti Suzuki India Ltd.	0.234	0.061	Undervalued
NMDC Ltd.	0.207	0.072	Undervalued
NTPC Ltd.	0.013	0.055	Overvalued
Oil & Natural Gas Corporation Ltd.	0.120	0.064	Undervalued
Power Grid Corporation of India Ltd.	0.079	0.048	Undervalued
Punjab National Bank	0.148	0.080	Undervalued
Reliance Industries Ltd.	0.027	0.068	Overvalued
Sesa Sterlite Ltd.	0.261	0.066	Undervalued
State Bank of India	0.113	0.081	Undervalued
Sun Pharmaceutical Industries Ltd.	-0.169	0.051	Overvalued
Tata Consultancy Services Ltd.	0.157	0.066	Undervalued
Tata Motors Ltd.	0.182	0.051	Undervalued
Tata Power Co. Ltd.	-1.810	0.020	Overvalued
Tata Steel Ltd.	0.290	0.042	Undervalued
Tech Mahindra Ltd.	0.254	0.036	Undervalued
UltraTech Cement Ltd.	0.107	0.058	Undervalued
United Spirits Ltd.	-0.048	0.095	Overvalued
Wipro Ltd.	0.167	0.066	Undervalued

Relative attractiveness of the security can be found out with the help of security market line. Stocks with high risk factor is expected to yield more return and vice versa. But the investor would be interested in knowing whether the security is offering return more or less proportional to its risk. The above the table provides an explanation for the evaluation. The securities which have high expected return compare to SML return are undervalued securities. From the above table we can interpret that in the year of 2012-13 out of 50 companies, 24 securities are overvalued and 26 securities are undervalued. In the year of 2013-14, 16 securities are overvalued and 34 securities are undervalued.

During 2012 to 2014, ACC Ltd, Ambuja Cement Ltd, Bharti Airtel Ltd, IDFC Ltd, NTPC Ltd, and TATA Power Co.Ltd securities which continuously overvalued because estimated returns are lower than its theoretical or expected return. This makes it undesirable and it is not attractive opportunity to invest in these 6 securities. While Axis Bank Ltd., HCL Technologies Ltd., Housing Development Finance Corporation Ltd., Lupin Ltd., Mahindra & Mahindra Ltd., Maruti Suzuki India Ltd., Tata Consultancy Services Ltd.,Tata Motors Ltd., Tech Mahindra Ltd. And UltraTech Cement Ltd. securities which continuously Undervalued because estimated return are Higher than its theoretical or expected return. It is making more attractive opportunities for investor to in these 10 securities

CONCLUSION:

Since the birth of CAPM in the 1960's as a model that allows investors to predict the expected return from investing in the stock market, numerous empirical studies had been carried out to analyze the applicability of CAPM in different stock markets. However, there are also abundant empirical evidences against CAPM, claiming there are other factors affecting return in the stock market rather than systematic market risk. There is no one model that can claim to have the absolute ability to predict the expected stock return. As such, it was the intention of this study to empirically examine the applicability of CAPM in the Indian stock market. If investor can buy Axis Bank Ltd., HCL Technologies Ltd., Housing Development Finance Corporation Ltd., Lupin Ltd., Mahindra & Mahindra Ltd., Maruti Suzuki India Ltd., Tata Consultancy Services Ltd., Tata Motors Ltd., Tech Mahindra Ltd. And UltraTech Cement Ltd. Securities then high possibility to increase the profit and if investor short sell ACC Ltd, Ambuja Cement Ltd, Bharti Airtel Ltd, IDFC Ltd, NTPC Ltd, and TATA Power Co.Ltd securities then increase profit. Portfolio manager also consider these securities to build an optimal portfolio.

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