



## Application of Capital Asset Pricing Model in Indian Stock Market

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### ABSTRACT

Capital Asset Pricing Model (CAPM) is one of the widely used measures of calculating the expected stock return. Investors in National Stock Exchange (NSE) also use it extensively. This study aims to find the applicability of CAPM in NSE and to establish risk and return relationship for individual securities. In this paper it is also tried to find whether the individual securities are overvalued or undervalued using CAPM so as to help the investors to take their buy and sell decision. Closing prices of top 10 different companies on the basis of their market capitalization from 2012 to 2016 have been considered. The basic model developed by William Sharpe (1964) and other authors in different times issued to serve the purpose. The research finds no applicability of CAPM in NSE as the difference between expectations and the actual results is very high at normal risk level.

**Keywords--** CAPM, Market Capitalization, NSE

### I. INTRODUCTION

Capital market is the most important part of financial system. It provides the interface to the buyer and seller for exchange of financial instruments. It plays an important role in the growth of the economy and considered as the barometer of economic growth. Indian capital market is one of the oldest in stock market in the Asian Market. There are 19 national and regional stock exchanges in India. Out of which Bombay Stock Exchange and National Stock Exchange are the biggest stock exchanges in term of market capitalization and number of companies listed. Indian stock market is quite volatile and flooded with many financial instruments. The selection of suitable security is a complex task. Investors need to be very careful while selecting the investment options. Every investment opportunity involves risk and return. The investors and analyst uses various model and techniques to evaluate the investment opportunities. Capital Asset Pricing Model (CAPM) is one of the important models used to evaluate any investment. This model was originally

proposed by Sharpe (1964). This model provides the framework for weighing the risk against expected return for determining securities prices. The total risk comprises of two types of risks- unsystematic risk or diversifiable risk and systematic risk which is also known as non diversifiable risk. CAPM takes into only systematic risk which is also known as market risk and represented by beta. A beta value of one is considered as the overall market average. Beta higher than one represents risk level greater than market average while beta lowers than one represents a level of risk below market average.

According to CAPM model, there exist positive linear relation between risk and return. Higher the risk higher will be the return. For the riskier securities the investors prefer higher return. The risk varies from securities to securities. There are some securities which are considered as risk free assets such as government bonds, treasury bills etc. In these securities the default risk is zero. Whereas in case of corporate bonds and shares there is risk of default so they are considered as risky investments. As the shares are more risky to bonds, investors expect high return for investing in shares. According to CAPM expected return is equal to the sum of risk free return and risk premium. Security Market Line (SML) is used to find how the individual securities should be priced in relation to their systematic risk. It is the graphical representation of CAPM which shows the different level of systematic risk of various marketable securities plotted against expected return of entire market at a given point of time. X axis of the chart shows the Beta whereas the Y axis shows the expected return. This model helps to identify whether the securities are undervalued or overvalued. when a security is plotted on SML chart, if it appears above the SML, it is considered undervalued because it shows that security offer greater return against its inherent risk. If the security appears below the SML, it is considered as overvalued as it does not overcome the inherent risk.

The equation for the CAPM model or SML line is:

Required return = risk free rate of return + Beta( market return - risk free rate of return)

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

Where

$E(R_i)$  - is the expected return on security calculated based on its risk to market portfolio.

$R_f$  - is the risk-free interest rate

$E(R_m)$  - is the expected return on the market portfolio

$\beta_i$  - indicates the sensitivity of change of return on a security to changes in return on market portfolio.

The equation used for calculating beta for each individual security,  $\beta_i$  is as follows:

$$\beta_i = \text{Cov}(R_i, R_m) / \sigma_m^2$$

where

$\text{Cov}(R_i, R_m)$  - is the covariance of return on security  $i$  ( $R_i$ ) and return on the market portfolio ( $R_m$ ), &

$\sigma_m^2$  - is the variance of the market portfolio.

## II. LITERATURE REVIEW

CudiTuncerGursoy, G. R. (2007) examined the validity of CAPM in Turkey market on 10 stocks for the period of 1995-2004. It was found that there is no relationship between beta coefficients and ex-post premiums of selected stocks. The results showed that high beta stocks perform better in up-market conditions whereas low-beta portfolio is better investment in down-market.

LoukerisNikolaos. (2009) examined the validity of CAPM on British stock exchange using monthly data collected from the period of January 1980 to February 1998 on 39 stocks from London Stock Exchange. The study found that Beta is a significant coefficient of measuring the returns and it is supported by CAPM. However, the slope of the security Market line was found different from the slope of SML indicated by CAPM in present research. Hence the validity of CAPM was rejected in present study.

KapilChoudhary, S. C. (2010) examined CAPM for the Indian Stock market using monthly stock returns from companies of BSE 500 index for the period of January 1996 to December 2009. It is found that higher beta is not associated with higher level of returns. The finding of the study contradicts with the hypothesis of CAPM. The study concluded that beta is not sufficient to determine the expected returns of securities JosipaDzaja, Z. A. (2013) examined CAPM model applicability on Central and South-East European emerging security markets using monthly stock returns for nine years for the period of January 2006 to December 2010. The study showed that CAPM is not adequate for accessing the capital assets on observed stock markets. The study showed that higher beta do not mean higher return. The study further concluded that the stock market returns do not lie on the efficient frontier so they do not represent efficient portfolios.

M. RizwanQamar, S. R. (2014) examined Capital Asset Pricing Model applicability on Pakistan Stock

markets. The study was conducted on the monthly return of Sample of ten performing companies of 100 index of Karachi Stock Exchange (KSE) from the period of five years from 2006 to 2010. The study do not support CAPM in Pakistani stock market and it shows different beta for all selected companies. The study concluded that CAPM is not reliable model to measure the risk and return on stock prices of Pakistan stocks traded on KSE. KhusbooRaheja (2014) examined the applicability of CAPM in India using the monthly prices of five individual securities from the period of Nov 2010 to October 2013. It is found that spread between the expected return and actual return is quite large.

ManishPathak K R (2015) examined the risk return relation of individual securities using the daily data 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. CAPM model is use to establish this relation. The study found that other than systematic risk there are various other factors that are affecting the return of securities

## III. OBJECTIVES OF THE STUDY

Considering the various studies on CAPM, the objective of this study is to test the applicability of CAPM in Indian Market. To test, the main objectives is sub divided into further sub objectives:

- To measure the risk of selected securities
- To measure the rate of return expected by the investors using CAPM model
- To find whether the selected securities are undervalued or overvalued

## IV. METHODOLOGY

To test the applicability of CAPM in the NSE, adjusted daily close prices of top 10 company's with highest market capitalization have been choose for the period from January 1, 2012 to December 31, 2016. The daily adjusted closing price of individual stock and Nifty is collected from yahoo finance. Market capitalization is taken as a base to select the companies as it gives the total value of the firm. Market capitalization value is calculated by multiplying the total number of share outstanding with price per share. It helps the investors to understand the relative size of a company against another. It helps to measure the worth of a company in the open market and provides the market's perception for the future prospects of a company and what the investors are willing to pay for its stocks. The companies are chosen from the list of 500 companies as per the survey of Economic Times which is one of the leading financial newspapers. For risk free rate of return the average daily return of government bonds has been used. CAPM formula has been used to know the beta of stocks for stipulated period. For testing the applicability

of CAPM in India, first the beta of each stock is calculated for different companies under the different years. The Beta coefficient (Slope) is calculated by regressing each stock's daily data against the market return. Using the CAPM the expected returns of each stock is calculated from 2012 till 2016 for the top ten companies having the highest market capitalization. Finally the actual return is compared to the expected return calculated using CAPM to find the reliability of return calculated using CAPM.

## V. HYPOTHESIS

Ho: Stock return does not depend on degree of risk

H1: Stock return and risk are correlated

## VI. JUSTIFICATION OF THE MODEL

Capital Asset Pricing Model calculates the total return comprising risk free return and the risk premium. Risk premium depends on the degree of risk taken (beta coefficient). The relation between risk and the return is linear and correlated. Higher the risk, higher the return as

risk free return is constant. CAPM equation is based on the assumptions of several factors like investors are risk-averse, market is frictionless, information is available but asymmetric in nature, investors can borrow unlimited amount at risk free rate and financial assets are perfectly divisible and have marketability (Copeland et al., 2004). The CAPM equation is as follows; Where, This study based on the data of nifty index from January 2012 to December 2016. The procedure is followed as already mentioned in the methodology.

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

$R_i$  = Return on asset I

$r_f$  = Risk free rate

$R_m$  = Return on the market portfolio

$\beta_i$  = Beta coefficient

$$\beta_i = \text{Cov}(R_i, R_m) / \sigma_m^2$$

where

$\text{Cov}(R_i, R_m)$  is the covariance of return on security  $i$  ( $R_i$ ) and return on the market portfolio ( $R_m$ ), &  $\sigma_m^2$  is the variance of the market portfolio.

## VII. EMPIRICAL FINDINGS

Table: 1

Top Ten Companies with Highest Market Capitalization									
2012		2013		2014		2015		2016	
Company	Market capitalization (CR)	Company	Market capitalization (CR)	Company	Market capitalization (CR)	Company	Market capitalization (CR)	Company	Market capitalization (CR)
Reliance Industrial Ltd	265,123	Tata consultancy Service Ltd	404,099	Tata Consultancy Service Ltd	487,972	Tata Consultancy Service Ltd	501,045	Tata Consultancy services Ltd	471,205
Tata consultancy Service Ltd	254,908	Reliance Industries Ltd	281,816	Oil and Natural Gas Corporation Ltd	352,970	Reliance Industries Ltd	276,995	Reliance Industries Ltd	348,859
Oil and Natural Gas Corporation Ltd	238,520	ITC Ltd	251,385	Reliance Industries Ltd	320,988	HDFC Bank Ltd	257,538	HDFC Bank Ltd	321,960
Coal India	225,301	Oil and Natural Gas Corporation Ltd	246,255	ITC Ltd	278,761	ITC Ltd	254,442	ITC Ltd	291,423

ITC Ltd	223,007	Infosys Ltd	196,874	Coal India Ltd	227,401	Infosys Ltd	252,702	Oil and Natural Gas Corporation Ltd	238,144
State Bank of India	150,592	Coal India Ltd	178,630	Infosys Ltd	204,020	Coal India Ltd	211,552	Infosys Ltd	235,984
HDFC Bank Ltd	148,628	HDFC Bank Ltd	161,234	HDFC Bank Ltd	198,307	Sun Pharmaceutical Industries Ltd	209,698	Housing Development Finance Corporation Ltd	216,966
Infosys Ltd	139,826	BhartiAirtel Ltd	131,344	State Bank of India	182,524	Oil and Natural Gas Corporation Ltd	196,857	Coal India Ltd	201,002
NTPC Ltd	139,192	Wipro Ltd	128,697	ICICI Bank Ltd	173,100	Housing Development Finance Corporation Ltd	185,517	State Bank of India	199,578
Hindustan Unilever Ltd	124,855	ICICI Bank Ltd	128,068	Sun Pharmaceutical Industries Ltd	167,492	State Bank of India	177,643	Hindustan Unilever Ltd	184,838

Source: <http://economictimes.indiatimes.com/et500>

**Table 1:** shows the top ten companies with highest Market capitalization in different years. Market capitalization is the market value of the shares. It indicates the perception of the investors in the company's future.

**Table :22012**

Companies	Market Capitalization (Cr)	Rf	Rm	Rm-Rf	$\beta$	$\beta(Rm-Rf)$	Expected Return $Rf+\beta(Rm-Rf)$	Actual Return	Valuation
Reliance industrial Ltd	265,123	8.28	25.67	17.39	(0.02)	(0.29)	7.99	23.85	Undervalued
Tata consultancy Service Ltd	254,908	8.28	25.67	17.39	(0.32)	(5.63)	2.65	12.56	Undervalued
Oil and Natural Gas Corporation Ltd	238,520	8.28	25.67	17.39	0.14	2.43	10.70	15.50	Undervalued
Coal India Ltd	225,301	8.28	25.67	17.39	(0.02)	(0.27)	8.00	22.23	Undervalued
ITC Ltd	223,007	8.28	25.67	17.39	(0.41)	(7.10)	1.18	40.74	Undervalued
State Bank of India	150,592	8.28	25.67	17.39	0.10	1.71	9.98	65.94	Undervalued
HDFC Bank Ltd	148,628	8.28	25.67	17.39	(0.10)	(1.74)	6.53	49.16	Undervalued
Infosys Ltd	139,826	8.28	25.67	17.39	(0.07)	(1.28)	7.00	(7.50)	Overvalued

NTPC Ltd	139,192	8.28	25.67	17.39	0.02	0.39	8.66	2.01	Overvalued
Hindustan Unilever Ltd	124,855	8.28	25.67	17.39	(0.32)	(5.56)	2.71	29.19	Undervalued

Table 3:2013

Companies	Market Capitalization (Cr)	Rf	Rm	Rm-Rf	$\beta$	$\beta(Rm-Rf)$	Expected Return Rf+ $\beta(Rm-Rf)$	Actual Return	Valuation
Tata Consultancy services Ltd	404,099	8.14	8.20	0.05	0.41	0.02	8.16	59.49	Undervalued
Reliance Industries Ltd	281,816	8.14	8.20	0.05	1.02	0.06	8.20	11.21	Undervalued
ITC Ltd	251,385	8.14	8.20	0.05	0.82	0.05	8.19	17.08	Undervalued
Oil and Natural Gas coropration Ltd	246,255	8.14	8.20	0.05	1.18	0.07	8.21	18.36	Undervalued
Infosys Ltd	196,874	8.14	8.20	0.05	0.41	0.02	8.17	54.40	Undervalued
Coal India Ltd	178,630	8.14	8.20	0.05	0.55	0.03	8.17	(11.73)	Overvalued
HDFC Bank Ltd	161,234	8.14	8.20	0.05	1.20	0.07	8.21	3.24	Overvalued
BhartiAirtel Ltd	131,344	8.14	8.20	0.05	1.08	0.06	8.20	11.09	Undervalued
Wipro Ltd	128,697	8.14	8.20	0.05	0.22	0.01	8.15	41.67	Undervalued
ICICI Bank Ltd	128,068	8.14	8.20	0.05	1.46	0.08	8.22	11.54	Undervalued

Table 4:2014

Companies	Market Capitalization (Cr)	Rf	Rm	Rm-Rf	$\beta$	$\beta(Rm-Rf)$	Expected Return Rf+ $\beta(Rm-Rf)$	Actual Return	Valuation
Tata Consultancy Service Ltd	487,972	8.58	28.09	19.51	0.45	8.70	17.27	21.24	Undervalued
Oil and Natural Gas Corporation Ltd	352,970	8.58	28.09	19.51	1.60	31.21	39.79	26.77	Overvalued
Reliance Industries Ltd	320,988	8.58	28.09	19.51	1.28	25.06	33.63	3.09	Overvalued
ITC Ltd	278,761	8.58	28.09	19.51	0.45	8.76	17.33	18.54	Undervalued
Coal India Ltd	227,401	8.58	28.09	19.51	1.28	24.91	33.49	43.18	Undervalued
Infosys Ltd	204,020	8.58	28.09	19.51	0.34	6.62	15.20	71.57	Undervalued
HDFC Bank Ltd	198,307	8.58	28.09	19.51	1.02	19.83	28.41	38.44	Undervalued
State Bank of India	182,524	8.58	28.09	19.51	1.19	23.26	31.83	903.45	Undervalued
ICICI Bank	173,100	8.58	28.09	19.51	2.13	41.62	50.19	393.05	Undervalued

Ltd									
Sun Pharmaceutical Industries Ltd	167,492	8.58	28.09	19.51	0.29	5.58	14.15	41.12	Undervalued

Table 5.2015

Companies	Market Capitalization (Cr)	Rf	Rm	Rm-Rf	$\beta$	$\beta(Rm-Rf)$	Expected Return $Rf+\beta(Rm-Rf)$	Actual Return	Valuation
Tata Consultancy Service Ltd	501,045	7.76	(2.84)	(10.60)	0.57	(5.99)	1.77	(1.30)	Overvalued
Reliance Industries Ltd	276,995	7.76	(2.84)	(10.60)	1.16	(12.32)	(4.56)	17.94	Undervalued
HDFC Bank Ltd	257,538	7.76	(2.84)	(10.60)	0.88	(9.37)	(1.61)	15.28	Undervalued
ITC Ltd	254,442	7.76	(2.84)	(10.60)	0.71	(7.57)	0.19	(4.85)	Overvalued
Infosys Ltd	252,702	7.76	(2.84)	(10.60)	0.96	(10.16)	(2.40)	75.52	Undervalued
Coal India Ltd	211,552	7.76	(2.84)	(10.60)	0.73	(7.78)	(0.02)	(5.71)	Overvalued
Sun Pharmaceutical Industries Ltd	209,698	7.76	(2.84)	(10.60)	0.89	(9.40)	(1.64)	6.22	Undervalued
Oil and Natural Gas Corporation Ltd	196,857	7.76	(2.84)	(10.60)	1.02	(10.86)	(3.10)	(24.67)	Overvalued
Housing Development Finance Corporation Ltd	185,517	7.76	(2.84)	(10.60)	1.34	(14.26)	(6.49)	16.43	Undervalued
State Bank of India	177,643	7.76	(2.84)	(10.60)	1.36	(14.47)	(6.71)	(26.76)	Overvalued

Table 62016

Companies	Market Capitalization (Cr)	Rf	Rm	Rm-Rf	$\beta$	$\beta(Rm-Rf)$	Expected Return $Rf+\beta(Rm-Rf)$	Actual Return	Valuation
Tata Consultancy services Ltd	471205	7.23	4.08	(3.14)	0.71	(2.22)	5.01	1.41	Overvalued
Reliance Industries Ltd	348859	7.23	4.08	(3.14)	0.81	(2.56)	4.66	9.79	Undervalued
HDFC Bank Ltd	321960	7.23	4.08	(3.14)	0.75	(2.37)	4.85	12.87	Undervalued
ITC Ltd	291423	7.23	4.08	(3.14)	0.95	(3.00)	4.23	34.40	Undervalued
Oil and Natural Gas Corporation Ltd	238144	7.23	4.08	(3.14)	0.54	(1.70)	5.52	43.18	Undervalued
Infosys Ltd	235984	7.23	4.08	(3.14)	0.76	(2.40)	4.83	(4.04)	Overvalued
Housing Development Finance Corporation Ltd	216966	7.23	4.08	(3.14)	1.03	(3.25)	3.98	4.16	Undervalued
Coal India Ltd	201002	7.23	4.08	(3.14)	0.78	(2.45)	4.77	2.63	Overvalued

State Bank of India	199578	7.23	4.08	(3.14)	1.60	(5.03)	2.20	19.27	Undervalued
Hindustan Unilever Ltd	184838	7.23	4.08	(3.14)	0.60	(1.88)	5.34	(0.29)	Overvalued

From the above data, it was found that in year 2012, the beta of ONGC was highest i.e. 0.14 and as per risk return relation, the ONGC must have earned highest return i.e. 10.70 calculated by CAPM and actually it earned return of 15.50 which was less than the actual return of SBI having highest actual return whereas its beta was less than ONGC. Similarly the ITC was having the lowest beta of negative 0.41 and as per risk return relation it must have lowest return on the contrary ITC was not having lowest return. Whereas, Infosys Ltd earned the lowest return.

Similar results were found in the following years too. In 2013 ICICI Bank was having the highest beta of 1.46 but TCS had earned the highest return in the market. TCS was on top in terms of market capitalization whereas ICICI bank was lower in rank in terms of market capitalization. In the year 2014 again ICICI Bank was having the highest beta of 2.13 while SBI earned the maximum return in the market. On the contrary Sun Pharma was having the lowest beta while RIL earned the lowest return. In year 2015 SBI was having the highest beta and lowest return. In 2016 ONGC was having the lowest beta 0.54 and highest return of 43.18.

These results show that stocks return don't depend on the stock beta and the results of CAPM cannot be relied upon.

## VIII. CONCLUSION

The purpose of this research is to test the applicability of CAPM in National Stock Exchange. Closing returns of top 10 companies for 5 years have been considered and it is found that the difference between expectation and actual return is very significant at normal risk level. So, any result may mislead the investors to forecast future movement of stocks. The intensity of differences implies that CAPM has no applicability in NSE.

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