CAPM - Empirical Evidence from the Indian Stock Market

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Abstract

The CAPM model does not hold very strong in stock markets as evidenced by recent empirical tests. However, it has become a basis for the development of other models of asset pricing or extension of the same model. The model advocated the efficiency and efficacy of different markets as far as pricing of capital assets is concerned, and it is the price fluctuations which are responsible for capital gains for investors. A large number of tests in asset pricing literatures have been carried out in developed nations. On the other hand, these tests are witnessed to be in dearth in developing nations, and India is not an exception. The emerging markets are more volatile, and this is the reason it is more interesting. The present piece of research attempted to explain the extent to which the CAPM model is able to explain price fluctuations in India. The study used NIFTY 50 companies as a sample. NIFTY 50 companies were also subcategorized by size and value, and the effect of size and value was detected on the return of the asset. It covered a period from April 1, 2009 to March 31, 2016. The CAPM was not found to be robust in explaining the asset returns. CAPM explained the returns more in case of portfolio assets as compared to individual assets, though the degree was very low. Big size firms outperformed the small size firms. Also, the low - value firms outperformed the high-value firms. In a majority of the cases, the market volatility was found in excess to the asset volatility.

Keywords: **CAPM, price fluctuations, volatility of markets, portfolio return, market beta**

JEL Classification: G10, G11, G12, G17

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In any economy, the savings are channelized to productive means through the intermediaries. Some intermediaries offer minimum returns without taking any risk by the investor, which is called risk free rate. If an investor wants to earn above risk free rate, he/she can invest in stocks, which are subjected to the market risk. So, an investor needs a model that best captures the market risk. The capital asset pricing model is not an exception. There is a deluge of literature on the model based on empirical evidences. Some researchers claim that CAPM is needed, dead or alive. Although, the model is surrounded with flood of criticisms, the model has proved itself to be a base for the development of other models or extension of the same. So, besides being dead in various empirical tests, it is alive due to its need in the development of other alternative models. The Indian stock market is an emerging market, so the price fluctuations are interesting. Some claim that the model is half right. In emerging markets, the investors' reaction is quick if there is any good or bad news about macroeconomic factors. The CAPM model captures the market risk based on risk free rate, market risk premium, and co-movements between asset return and market return, but is unable to capture the behaviour of macroeconomic factors. The co-movements between asset return and market return in downside will capture the market in upside to a greater extent. As per CAPM, the positive monotonic co-movements will increase the capital gain of the investors.

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Literature Review

Fama and French (1996) concluded that beta alone is not sufficient to capture the systematic risk. They also concluded that there is a significant size effect on expected returns.

Patton and Timmermann (2010) said that the conditions under which the traditional asset pricing models are tested are general, and it cannot be very exactly said that the relationship between the explanatory variables and explained variable is monotonic. They said that these tests are non-parametric and do not have any presupposition about the functional form between the expected return of the asset and the sorting variables. So, they concluded that the non-parametric tests having a monotonic functional form between sorting variables and explanatory variable were not adequate to capture the systematic risk.

Basu and Chawla (2010) said that there is a flood like situation with respect to the number of tests concerned for asset pricing. Mostly, these tests have been carried out for the developed countries. These tests suggest that there is a need of new models or the extension of the available theory is needed. In developing countries like India, the empirical tests on CAPM or the traditional asset theory are in dearth, and sifting is required for these models. However, the authors concluded that CAPM is dead in India.

Levy (2010) concluded that the CAPM is alive and well. He said that CAPM is criticized by researchers on empirical grounds because the expected returns of the assets never come out to be normal. He said that empirically, researchers have made criticism of the CAPM, bur ex-ante parameters support the theory strongly.

Hwang, Min, McDonald, Kim, and Kim (2010) found that the CAPM has anomalies in the same fashion as the Fama and French model. In their study, the CAPM showed higher explanatory power for size and value sorted portfolios.

Baker, Bradley, and Wugler (2011) came up with an antithetical outcome. It was concluded that low-beta and low-volatility outperformed high-beta and high-volatility stocks. This oddity, to a certain extent, may be put into words by the reality that typical institutional investors' authority to win against a fixed standard made the arbitrage activity downhearted in high-alpha, low-beta and low-alpha, high-beta stocks.

De Giorgi, Hens, and Levy (2011) said that the CAPM holds true under the two basic assumptions ; first, the asset returns are normally distributed, and second, the security market line is consistent with the financial market equilibrium. However, as claimed by Tversky and Kahneman (1992), the financial market equilibrium does not exist for the utility index.

Ho, Tsai, Tzeng, and Fang (2011) said that the risk-free rate, expected return on market portfolio, and asset beta cannot be overlooked in capturing the systematic risk. Apart from these sorting variables, investors should also give due importance to the macroeconomic factors such as financial risk, budget deficit, tax structure, and discount rate, etc.

Abdymomunov and Morley (2011) checked the response of beta and market risk premium at two stages, namely at low volatility and at high volatility. Their test gave strong evidence in favour of conditional CAPM for all regimes of volatility. In many cases, especially at high volatility regimes, the unconditional CAPM was accepted.

Teplova and Shutova (2011) carried out their survey for two different periods in the Russian stock market. The first period was financially stable period, and the second was the crisis period. They found that the unconditional CAPM had very low explanatory power ; whereas, the test results were insignificant for the crisis period.

Abbas, Ayub, Sargana, and Saeed (2011) concluded that the downside CAPM is the long-awaited replacement for the standard beta. Some authors say that CAPM is needed, dead or alive. Some conclude that we should not rely on mathematical models to capture the market. So generally, the researchers criticize the CAPM model, but they have no replacement for the model. In the bearish periods, when we face financial crises, some investors associate CAPM with risk of potential loss. The beta in this situation can better explain the market for all periods.

Da, Guo, and Jagannathan (2012) concluded that the empirical tests are not in favour of the CAPM or the

CAPM has proven itself not enough to capture the systematic risk. In spite of that, one cannot abandon the use of CAPM and favour other functional forms of theories because the CAPM has proven itself to be a benchmark on the basis of which other theories can be developed.

Ward and Muller (2012) found that the data evidence of Jakarta Stock Exchange contradicted the CAPM model. Although there was a monotonic relationship between asset return and beta, but the relationship was inversely proportional. In CAPM, the security market line rises with beta, that is, as we increase beta, the return of the asset will also increase. However, their 15 years sample till 2004 revealed that if the beta was increased, the return of the underlying asset decreased. After 2004 till 2011, this sample period revealed that there was no association between asset returns and beta. Also, their major findings are : (a) there was a positive relation between asset returns and size, and (b) there was no relation between asset returns and book equity to market equity ratio.

Smith and Walsh (2013) said that the CAPM is half right. They argued that the market very quickly reacted to good news as well as to bad news. The investor has to rely on the traditional CAPM in the absence of another theory. The theory is unspecified. Researchers till now are only able to extend or develop the existing model because the existing model is misplaced. So, the CAPM is unable to capture the systematic risk for good or bad news. This is the reason it is half right.

Brown and Walter (2013) argued that the CAPM is a futuristic concept where we try to predict the future returns based on the past returns. In such a situation, the theory will be valid if the macroeconomic parameters keep the same way as in the past. On the other hand, the empirical ways to validate the test are ex-post. The CAPM paves a way to think about risk - return trade off for an efficient portfolio. The degree with which the model captures the market behaviour faces two challenges; first, investors assume that the tests are valid and second, the investors believe that they will not be compensated for the unavoidable risks.

Moosa (2013) suggested that we should stop relying on econometric and mathematical models to capture the market. CAPM is true under certain conditions, and the conditions imposed are not real practically. So, finance must be understood from the point of view of historical finance and must use some other social sciences tools to understand the market behaviour. Finance is not Physics where Boyle's law is a reality under certain conditions.

Barberes, Greenwood, Jin, and Shleifer (2015) said that the investors believe that the future returns would follow the same pattern as in the past. They believe that if the past is well, the future will also be well. This type of mindset is not consistent with the recent asset pricing models. The authors claimed that most of the investors are hardcore about their beliefs on the past, but some are rational. The survey conducted by the authors empirically supported CAPM to the greater extent.

Bajpai and Sharma (2015) concluded that the CAPM failed to capture the systematic risk, but if the intercept term was removed, the model captured the market better.

Panwar (2016) said that the CAPM is worthy of attention in the written works of finance. The model performs the duties for the development of other portfolio theories. The health of the model has always been a centre of attraction for the researchers. A deluge of experiments has been carried out for the developed economies. Experimenting with the model for a developing economy like India will produce interesting results due to large fluctuations in the stock prices. The study signalled that for a given time scaffold, the CAPM was not robust. It advocated for the inclusion of other factors besides the market risk premium.

Pandey and Sehgal (2016) documented a robust size effect in the Indian stock market. The returns of capital assets decreased with increase in size of the firms and vice-versa.

Aggarwal (2017) came to a conclusion that the three-factor model was better than the prolonged CAPM in the Indian stock market. The superiority of the Fama and French three-factor model over portfolio theories proposed by Sharpe (1964), Lintner (1965), Mossin (1966), and Black (1972) was confirmed in the study.

Shah (2018) concluded that during the financial crisis period, the traditional asset pricing models failed. In such a scenario, the investors need an alternative asset pricing model based on risk approaches.

Anwar and Kumar (2018) said that CAPM and Fama and French three-factor model were robust in the Indian financial sector than in the non-financial sectors. The two-factor model with market risk premium and value premium was found to be very close to the three-factor model. It was also observed that the three-factor model had superiority over CAPM.

Objectives of the Study

- To determine the explanatory power of the CAPM model for individual assets and portfolio assets in the Indian stock market.
- To analyze the applicability of size effect of the CAPM model in the Indian stock market.
- To analyze the applicability of value effect of CAPM model in the Indian stock market.

Research Methodology

The CAPM is given by the following equation :

$$R_{it} = R_f + \beta_{iM}[E(R_m) - R_f] + e_{it}$$

$$\text{Or, } (R_{it} - R_f) = \alpha_i + \beta_{iM}[E(R_m) - R_f] + e_{it} \qquad (1)$$

where,

R_{it} is the return on asset *i* at time *t*,

R_f is the risk free rate,

α_i is the unconditional mean return of asset *i* or the intercept term which is to be proven zero,

β_{iM} is the beta or the sensitivity of the asset and is defined as the covariance between returns of an asset and returns of market portfolio and is to be proven other than zero,

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

$[E(R_m) - R_f]$ is the extra return on market portfolio,

& e_{it} is the error term.

The β of an asset compares the volatility of its returns to the volatility of the market returns.

If :

$\beta = 1$, the volatility of the market and the volatility of the asset are same,

$\beta > 1$, the volatility of the market is less than the volatility of the asset,

$\beta < 1$, the volatility of the market is greater than the volatility of the asset.

(1) Hypotheses

- **H_{a1}:** There is a significant relationship between excess returns on security / portfolio and excess returns on market (Test of linearity).
- **H_{a2}:** Abnormal returns on security/ portfolio are not significant (Test of abnormal profit/intercept term).
- **H_{a3}:** There is a significant effect of excess returns of market on excess returns on security / portfolio (beta coefficient test).

(2) Sample : There are 71 companies who are witnessed to be in Nifty 50 from April 1, 2009 to March 31, 2016.

This period is the sample period. Out of these 71, the number of standing companies is 32. For the purpose of regression, two types of dependent variables are used, first individual asset returns and second portfolio asset returns. So, for individual asset returns, the daily returns of these 32 have been calculated.

The following data were collected from PROWESS, an online database maintained by CMIE (Centre for Monitoring Indian Economy) :

(i) Daily adjusted closing price of companies belonging to Nifty 50 for the purpose to calculate the daily arithmetic return.

(ii) Quarterly data of market capitalization of companies belonging to Nifty 50 from March 2009 to December 2015.

(iii) Quarterly data of P/B ratio of companies belonging to Nifty 50 from December 2008 to September 2015.

For the purpose to get the "market risk proxy," the Nifty 50 index has been used. The daily expected market return (arithmetic) is calculated using the close value.

For risk free rate, the 91 day treasury bills rate is used. The 91-day treasury bills are auctioned on every Wednesday of the week and implied yield is published in the RBI bulletin. From this rate, the daily rate was calculated using the following formula :

Let, the principal amount of P units become an amount of A units, then :

$$A = P(1+r)^t$$

$$\text{Or, } A - P = P[(1+r)^t - 1]$$

$$\text{Or, } \frac{(A-P)}{P}(1+r)^t - 1$$

The right - hand side of the above equation is the annual implied yield and in the left-hand side, r denotes the daily rate, now :

$$Annual\ implied\ yield = (1 + Daily\ rate)^t - 1$$

The RBI website provides the annual implied yield of 91-days treasury bills. Therefore, approximately, the number of days in a year may be taken as 364 (91× 4) as there are four quarters in a year. Therefore :

$$1 + Annual\ implied\ yield = (1 + Daily\ rate)^{364}$$

$$\text{Or, } (1 + Annual\ implied\ yield)^{\left(\frac{1}{364}\right)} = (1 + Daily\ rate)$$

Therefore,

$$Daily\ rate = (1 + Annual\ implied\ yield)^{\left(\frac{1}{364}\right)} - 1 \qquad (2)$$

The above daily has been used for Wednesday, Thursday, Friday, Monday, and Tuesday. From next Wednesday, the new rate is applicable in this study.

Secondly, as a dependent variable, the portfolio asset return has been used. For the purpose to construct a portfolio, Nifty 50 has been sub-categorized on the basis of size and value. Size is defined as the market capitalization of the company and value is defined mathematically as the BE/ME (book equity to market equity ratio). Size has two breakpoints, namely small and big. The company having size less than the median is small sized company and the company having size more than the median is big sized company. On the other hand, value

is having three breakpoints (30^{th} and 70^{th} percentile breakpoints). These breakpoints are called low value firms, mid value firms, and high value firms. So, based on these breakpoints, we have six portfolios, which are as follows :

(i) SL (Small sized and low value firms),
(ii) SM (Small sized and mid value firms),
(iii) SH (Small sized and high value firms),
(iv) BL (Big sized and low value firms),
(v) BM (Big sized and mid value firms),
(vi) BH (Big sized and high value firms).

Suppose, we want to construct portfolios for the first quarter of 2009, that is, for April, May, and June 2009. For this, BE/ME ratio will be of the third quarter of 2008 and market capitalization will be of fourth quarter of 2008. If there is an interim change in Nifty 50 list within the quarter, for example Jindal Steel & Power Ltd. witnessed inclusion into the index and Reliance Petroleum Ltd. was excluded from the index, new portfolios have been constructed based on the above categorization.

Analysis and Results

As depicted in the Table 1, the *F* - statistic is significant for all the individual assets, and we may infer that the data evidence does not support the null hypothesis and we must accept the alternative hypothesis (H_{a1}) which says that the asset returns and excess returns on market portfolio are linearly related, that is, all the assets pass the test of linearity. The BIC (Bayesian Information Criterion) is a model selection criterion. The most negative value of BIC is in the case of HDFC Bank Ltd. So, we may say that the returns of HDFC Bank Ltd. are best explained by the CAPM followed by the returns for Reliance Industries Ltd. and ITC Ltd. The average adjusted R^2 is found to be 27.74 %, that is, we may infer that CAPM cannot best explain the returns of an asset, and we need a model that best explains the returns of an asset, and we are left with the options of Fama and Fench three factor model and five factor model. These models are just extensions of the benchmark CAPM. The adjusted R^2 has its maximum value in case of ICICI Bank Ltd. with 53.30% followed by Larsen & Toubro Ltd. and HDFC Bank Ltd. with 45.35% and 45.42 %, respectively. The sign of coefficient β is positive in all cases, which means that there is a positive reward for each unit of risk taken by the investor. In case of Tata Steel Ltd., for each unit of risk, the return increases by 1.185 times. Larsen & Toubro Ltd. has a R^2 and the return of this asset increases 1.069 times the market risk premium.

The Table 2 represents various regressions of individual asset returns minus the risk-free rate as the dependent variable and excess returns on market portfolio as the independent variable. The Table 3 represents the combined test for the intercept terms. The GRS test statistic (Table 3) is found to be insignificant. So, we must reject the alternative hypothesis (H_{a2}). The data evidence supports the null hypothesis, and we may infer that overall, the intercept term is zero, or in other words, we can say that the unconditional mean/abnormal profit is zero. In Table 2, the intercept terms (α) are individually significant in case of Bharat Heavy Electricals Ltd. at 10%, HCL Technologies Ltd. at 1%, HDFC Bank Ltd. at 5%, Mahindra & Mahindra Ltd. at 10%, Sun Pharmaceuticals Ltd. at 5%, Tata Consultancy Services Ltd. at 5%, and Tata Motors Ltd. at 5% level of significance. So, in case of Bharat Heavy Electricals Ltd., HCL Technologies Ltd., HDFC Bank Ltd., Mahindra & Mahindra Ltd., Sun Pharmaceuticals Ltd., Tata Consultancy Ltd., & Tata Motors Ltd., we must accept the alternative hypothesis (H_{a2}). This means that these assets witnessed unconditional mean or abnormal profits. Also, in Table 2, all the slope coefficients are found to be significant. So, we must accept the alternative hypothesis (H_{a3}), and we may

infer that there is a significant effect of excess returns on the market on excess returns on security/portfolio.

In the Figure 1, it can easily be seen that in 78% of the cases, the slope coefficient is less than 1, which means that the market volatility is more than the volatility of the asset or the degree of association between market returns and asset returns is very low. In the remaining 22% of the cases, the market volatility is less than the volatility of the asset or the degree of association is very high between market returns and asset returns.

The Table 4 shows the regression of returns of six asset portfolios based on size and value. Hence, H_{a1} is

Table 1. Test of Linearity and Explanatory Power in Case of Individual Asset Returns

Company	*F*	[*p*-value]	R^2	Adjusted R^2	*SD* (Resid)	BIC
ACC	629.7***	[8.056e-119]	0.2663	0.2659	0.0151	-9617.52
AMBUJA CEMENT	514.9***	[4.99e-100]	0.2288	0.2284	0.01802	-9001.9
AXIS BANK	1306***	[1.077e-213]	0.4295	0.4291	0.01779	-9048.03
BHEL	642***	[9.058e-121]	0.2701	0.2697	0.02065	-8529.96
BPCL	254.8***	[1.246e-53]	0.1281	0.1276	0.02016	-8613.64
BHARTI AIRTEL	442.1***	[1.292e-87]	0.2031	0.2026	0.01935	-8754.53
CAIRN	564.2***	[3.189e-108]	0.2454	0.245	0.01815	-8977.23
CIPLA	298.6***	[7.351e-62]	0.1468	0.1463	0.01543	-9541.4
GAIL	410.8***	[3.739e-82]	0.1915	0.191	0.01676	-9254.56
HCL TECH	443.7***	[6.698e-88]	0.2037	0.2032	0.01966	-8700.36
HDFC BANK	1440***	[6.872e-230]	0.4535	0.4532	0.01154	-10551.2
HEROMOTOCO	350.5***	[2.171e-71]	0.1681	0.1676	0.01761	-9081.91
HINDALCO	859.9***	[7.314e-154]	0.3314	0.331	0.0226	-8215.41
HINDUSTAN UNILEVER	158.9***	[6.25e-35]	0.0839	0.0834	0.0156	-9503.08
HDFC	1388***	[9.894e-224]	0.4445	0.4441	0.01468	-9713.83
ICICI BANK	1983***	[1.988e-289]	0.5333	0.533	0.01573	-9475.6
ITC	449.7***	[6.317e-89]	0.2058	0.2054	0.01466	-9720.41
INFY	409.8***	[5.58e-82]	0.1911	0.1906	0.01656	-9296.54
L & T	1442***	[3.998e-230]	0.4538	0.4535	0.01565	-9493.54
M&M	817.1***	[1.363e-147]	0.3202	0.3198	0.0174	-9124.54
MARUTI	486***	[3.747e-95]	0.2188	0.2184	0.01669	-9268.35
NTPC	520.8***	[4.996e-101]	0.2309	0.2304	0.01472	-9705.31
ONGC	561.2***	[1.023e-107]	0.2444	0.244	0.01744	-9115.88
POWERGRID	570.8***	[2.714e-109]	0.2475	0.2471	0.01334	-10047.2
PNB	774.6***	[2.95e-141]	0.3087	0.3083	0.01859	-8894.78
RELIANCE	1332***	[6.892e-217]	0.4343	0.434	0.01391	-9902.52
SBIN	1200***	[2.811e-200]	0.4088	0.4085	0.0168	-9246.92
SUNPHARMA	291.2***	[1.748e-60]	0.1437	0.1432	0.01772	-9060.39
TCS	477.8***	[9.295e-94]	0.2159	0.2155	0.01598	-9420.16
TATA MOTORS	789.5***	[1.76e-143]	0.3127	0.3123	0.02209	-8294.96
TATA POWER	580.8***	[6.19e-111]	0.2508	0.2504	0.01753	-9097.67
TATA STEEL	1053***	[5.965e-181]	0.3777	0.3774	0.0203	-8588.66

Note. Number of observations = 1737 ; *** indicates significant at 1% level.

Table 2. Test of Intercept Terms and Coefficients for Individual Asset Returns

Company	α	[*p* - value]	β	[*p* - value]
ACC	0.000173	[0.6328]	0.6817***	[8.056e-119]
AMBUJA CEMENT	0.000386	[0.373]	0.7359***	[4.99e-100]
AXIS BANK	0.00055	[0.1979]	1.157***	[1.077e-213]
BHEL	-0.0008675*	[0.08026]	0.9413***	[9.058e-121]
BPCL	0.000693	[0.1523]	0.5789***	[1.246e-53]
BHARTI AIRTEL	-0.00021	[0.6509]	0.7322***	[1.292e-87]
CAIRN	-0.00041	[0.344]	0.7759***	[3.189e-108]
CIPLA	0.000226	[0.5424]	0.4798***	[7.351e-62]
GAIL	-6.91E-05	[0.8637]	0.6112***	[3.739e-82]
HCL TECH	0.001322***	[0.005137]	0.7451***	[6.698e-88]
HDFC BANK	0.0005704**	[0.03963]	0.7878***	[6.872e-230]
HEROMOTOCO	0.000317	[0.453]	0.5934***	[2.171e-71]
HINDALCO	-2.49E-05	[0.9634]	1.193***	[7.314e-154]
HINDUSTAN UNILEVER	0.000533	[0.155]	0.3539***	[6.25e-35]
HDFC	0.00036	[0.3069]	0.9844***	[9.894e-224]
ICICI BANK	0.000256	[0.4971]	1.26***	[1.988e-289]
ITC	0.000431	[0.2212]	0.5592***	[6.317e-89]
INFY	0.000469	[0.2385]	0.6032***	[5.58e-82]
L & T	0.000144	[0.7021]	1.069***	[3.998e-230]
M&M	0.0007021*	[0.09294]	0.8949***	[1.363e-147]
MARUTI	0.000599	[0.1354]	0.6622***	[3.747e-95]
NTPC	-0.0005	[0.1536]	0.6045***	[4.996e-101]
ONGC	-0.00026	[0.5349]	0.7435***	[1.023e-107]
POWERGRID	-0.00011	[0.7398]	0.5735***	[2.714e-109]
PNB	-0.00033	[0.4623]	0.9309***	[2.95e-141]
RELIANCE	-0.00024	[0.481]	0.9133***	[6.892e-217]
SBIN	-6.26E-05	[0.8766]	1.047***	[2.811e-200]
SUNPHARMA	0.0009066**	[0.03324]	0.5442***	[1.748e-60]
TCS	0.0009854**	[0.01029]	0.6285***	[9.295e-94]
TATA MOTORS	0.001051**	[0.04777]	1.117***	[1.76e-143]
TATA POWER	-0.00039	[0.3486]	0.7603***	[6.19e-111]
TATA STEEL	-0.00012	[0.8041]	1.185***	[5.965e-181]

Note. Number of observations = 1737 ; *** indicates significant at 1% level ; ** indicates significant at 5% level ; and * indicates significant at 10% level.

Table 3. Combined Test of Intercept Terms for Individual Asset Returns

	Statistic	[*p*-value]
GRS Test	1.189	[0.2163]

Figure 1. Graphical Representation for the Slope Coefficient of Extra Returns on Market Portfolio in Case of Individual Asset Returns

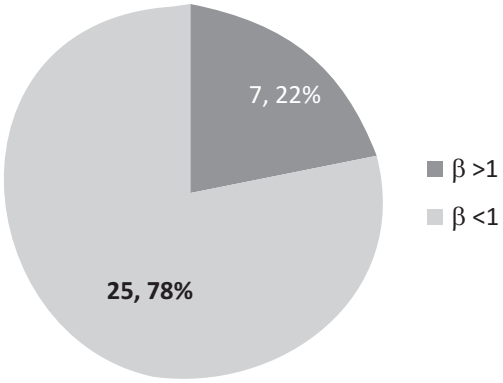


Table 4. Test of Linearity and Explanatory Power in Case of Portfolio Asset Returns

Portfolio	*F*	[*p*-value]	R^2	Adjusted R^2	*SD* (Resid.)	BIC
SH	2152***	[3.148e-306]	0.5537	0.5534	0.01227	-10336.7
SM	2989***	[0]	0.6328	0.6325	0.00838	-11662.6
SL	1556***	[1.99e-243]	0.4727	0.4724	0.009397	-11264.5
BH	3149***	[0]	0.6447	0.6445	0.009521	-11219.1
BM	4418***	[0]	0.718	0.7179	0.006981	-12297.3
BL	3879***	[0]	0.691	0.6908	0.006405	-12596.2

Note. Number of observations = 1737 ; *** indicates significant at 1% level.

Note. SL = Small sized and low value firms ; SM = Small sized and mid value firms ; SH = Small sized and high value firms ; BL = Big sized and low value firms ; BM = Big sized and mid value firms ; BH = Big sized and high value firms

Table 5. Test of Intercept Terms and Coefficient Terms in Case of Portfolio Returns

Portfolio	α	[*p*-value]	β	[*p*-value]
SH	-0.00027	[0.3672]	1.025***	[3.148e-306]
SM	0.000171	[0.3947]	0.8244***	[0]
SL	0.000605***	[0.007388]	0.6669***	[1.99e-243]
BH	-2.52E-05	[0.9123]	0.9613***	[0]
BM	-2.75E-05	[0.8695]	0.8349***	[0]
BL	0.0002992*	[0.05184]	0.7178***	[0]

Note. Number of observations = 1737 ; *** indicates significant at 1% level ; * indicates significant at 10% level.

accepted in this case. The *F*-statistic is significant in each case, which means the returns of each portfolio asset is linearly related to excess returns on market portfolio. The average adjusted R^2 for the six portfolio asset returns is found to be 61.85%, which is much more than the individual asset returns. It may be because of the fact that a portfolio is a composition of individual assets and the loss of one is maintained by the gain of the other. Besides that, it may be possible that investors rely not only on excess returns on market portfolio, but also on size and

value. In case of small - sized firms, the variation in portfolio returns is explained by market returns, which is 55.28%, and in case of big sized firms, it is 68.45%. In case of high - value firms, the extent to which the independent variable is able to predict the dependent variable is 59.89% and for low value firms, it is 58.16%.

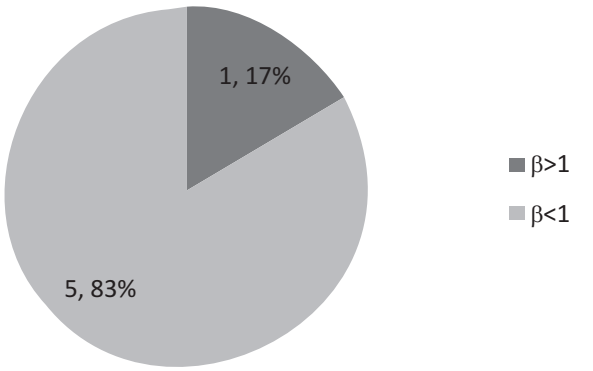
In Table 5, the intercept terms are found to be insignificant, except in the case of returns of SL portfolio. In case of SL portfolio, we must reject the null hypothesis as the data evidence is in support of the alternative hypothesis (H_{a2}). So, for this portfolio, we may infer that the intercept term is non-zero and there is a possibility of abnormal profit. In case of BL portfolio, the intercept term is significant at the 10% level, but is insignificant at 5%. So, the data evidence is in support of the null hypothesis at 5%, and we can say that the intercept term is zero, and there is no possibility of abnormal profit. The GRS test statistic (Table 6) is also found to be significant at the 10%, but insignificant at the 5% level of significance. So, overall, we accept the alternative hypothesis (H_{a2}). We may conclude that the intercept term is zero. Also, all the slope coefficients are found to be significant. So, we accept H_{a3} for each portfolio.

In Figure 2, in case of 83% of the portfolios, the beta is found to be less than 1, implying that in these portfolios, the market volatility is more than the portfolio returns or the degree of association is very low between market returns and portfolio returns. On the other hand, in only 17% of the cases, the market beta is higher than 1, meaning that either the degree of association between market returns and portfolio returns is high or market volatility is less than the portfolio volatility.

Table 6. Combined Test of Intercept Terms in Case of Portfolio Returns

	Statistic	[*p*-value]
GRS Test	2.04*	[0.05739]

Figure 2. Graphical Representation for the Slope Coefficient of Extra Returns on Market Portfolio in Case of Portfolio Asset Returns



↳ **Detection of Low Volatility Anomaly or the Market Risk Anomaly :** In Table 7, the coefficient of correlation between the unconditional returns (alpha) and coefficient of market risk premium (beta) is found to be -0.14983. So, the situation of low - alpha /high-beta and high-alpha/low-beta is confirmed. What we infer from this is that low volatility anomaly or market risk anomaly prevails in the Indian stock market. Low volatile stocks will yield higher returns than high volatile stocks.

In Table 8, the coefficient of correlation between the intercept terms or the abnormal returns, and the coefficient of market risk premium is found to be -0.9354. There is a strong and negative correlation between ALPHA and BETA. So, the presence of low volatility anomaly or the market risk anomaly is confirmed by the data evidence.

Table 7. Intercept Terms and Beta Coefficients of Individual Assets

Company	Intercept	Beta	Company	Intercept	Beta
ACC	0.000173	0.6817	ITC	0.000431	0.5592
AMBUJA CEMENT	0.000368	0.7359	INFY	0.000469	0.6032
AXIS BANK	0.00055	1.157	L & T	0.000144	1.069
BHEL	-0.00087	0.9413	M&M	0.000702	0.8949
BPCL	0.000693	0.5789	MARUTI	0.000599	0.6622
BHARTI AIRTEL	-0.00021	0.7322	NTPC	-0.0005	0.6045
CAIRN	-0.00041	0.7759	ONGC	-0.00026	0.7435
CIPLA	0.000226	0.4798	POWERGRID	-0.00011	0.5735
GAIL	-6.91E-05	0.6112	PNB	-0.00033	0.9309
HCL TECH	0.001322	0.7451	RELIANCE	-0.00024	0.9133
HDFC BANK	0.00057	0.7878	SBIN	-6.26E-05	1.047
HEROMOTOCO	0.000317	0.5934	SUNPHARMA	0.000907	0.5442
HINDALCO	-2.49E-05	1.193	TCS	0.000985	0.6285
HINDUSTAN UNILEVER	0.000533	0.3539	TATA MOTORS	0.001051	1.117
HDFC	0.00036	0.9844	TATA POWER	-0.00039	0.7603
ICICI BANK	0.000256	1.26	TATA STEEL	-0.00012	1.185

Table 8. Intercept Terms and Beta Coefficients of Portfolio Assets

Portfolio	Intercept	Beta
SH	-0.00027	1.025
SM	0.000171	0.8244
SL	0.000605	0.6669
BH	-2.52E-05	0.9613
BM	-2.75E-05	0.8349
BL	0.0002992	0.7178

Detection of Size Anomaly : In Table 9, for high value firms, irrespective of the size, the unconditional mean return in case of SH is found to be -0.00027, and the unconditional mean return of BH is found to be -2.52E-05. The difference between the unconditional mean returns of SH and BH portfolio returns is -2.45E-04 (-8.91% annually). The *t*-stat for the two series of returns (SH and BH) is -0.36543 with a *p*-value of 0.714812. So, we may infer that the two series are the same, although a negative unconditional mean return of 8.91% has been documented. The data evidence is rejecting the size effect, and we may conclude that big size firms outperform the small size firms.

In Table 9, for mid value firms, irrespective of the size, the unconditional mean return in case of SM is found to be 0.000171, and the unconditional mean return of BM is found to be -2.75E-05. The difference between the unconditional mean returns of SM and BM portfolio returns is 1.99E-04 (7.23% annually). The *t*-stat for the two series of returns (SM and BM) is 0.424537 with a *p*-value of 0.671201. So, we may infer that the two series are the same. The abnormal returns are found to be positive and robust. The data evidence is supporting the size effect in case of high value firms, and we may conclude that small size firms outperform the big size firms.

In Table 9, for low value firms, irrespective of the size, the unconditional mean return in case of SL is found to be 0.000605, and the unconditional mean return of BL is found to be 0.0002992. The difference between the

Table 9. Detection of Size Anomaly and Value Anomaly

Portfolio	Intercept Term	Portfolio of the Premium	Daily Risk Premium	Implied Yield (Annually)	*t* -statistic	*p* - value
SH	-0.00027	SH-BH	-0.00025	-8.91%	-0.36543	0.714812
SM	0.000171	SM-BM	0.000199	7.23%	0.424537	0.671201
SL	0.000605	SL-BL	0.000306	11.13112%	0.68321	0.49452
BH	-2.5E-05	SH-SL	-0.00088	-31.85%	-1.3301	0.183582
BM	-2.8E-05	BH-BL	-0.00032	-11.8%	-0.4649	0.642034
BL	0.000299					

unconditional mean returns of SL and BL portfolio returns is 0.000306 (11.13% annually). The *t*-stat for the two series of returns (SL and BL) is 0.68321 with a *p*-value of 0.49452. So, we may infer that the two series are the same. The abnormal return is found to be positive and robust. The data evidence supports the size effect in case of high value firms, and we may conclude that small size firms outperform the big size firms.

Finally, keeping the value effect constant, the data evidence confirms the size effect in two out of three cases. However, the CAPM breaks down to capture the size effect. The adj. R^2 of small size firms is very low as compared to the big size firms (Table 4), showing that there are unexplained variations in the returns of small size firms.

Detection of Value Anomaly : In Table 9, the unadjusted mean return in case of SH is found to be -0.00027 and in case of SL, it is found to be 0.000605. The difference between the unconditional means is -0.00088 (-31.85% annually), which is negatively robust. The *t* - statistic for the two portfolios return series (SH and SL) is found to be -1.3301 with a *p* - value of 0.183582. So, the return series are significant. Although, a negative unconditional mean has been documented, the data evidence does not confirm the superiority of high value firms over low value firms. Hence, we may infer that the growth firms (low value firms) outperform distressed firms (high value firms).

Also, as can be inferred from the Table 9, the unadjusted mean return in case of BH is found to be -2.52E-05 and in case of BL, it is found to be 0.0002992. The difference between the unconditional means is -3.24E-04 (-11.8% annually), which is negatively robust. The *t* -statistic for the two portfolios return series (BH and BL) is found to be -0.4649 with a *p* -value of 0.64034. So, the return series are significant. Although, a negative unconditional mean has been documented, the data evidence does not confirm the superiority of high value firms over low value firms. We may infer that the growth firms (low value firms) outperform distressed firms (high value firms).

Finally, keeping the size effect constant, the data evidence does not support the value effect in either of the above mentioned two cases. However, the CAPM break downs to capture the value effect. The adj. R^2 of small size firms as well as big size firms is low. It signals that there may be unexplained variations in the return series of the small size as well as the big size firms.

Conclusion

The study is based on two types of assets. The one is individual asset, and the other is a portfolio asset. For individual asset, the explanatory power of the market risk premium is very low. On the other hand, for portfolio asset, the explanatory power of CAPM is quite satisfactory. These outcomes are similar to the findings of Fama and French (1993) and Hwang et al. (2010).

The study confirms the existence of low volatility anomaly or market risk anomaly in the Indian stock market. The findings are similar to the findings of Baker et al. (2011). Big size and high value firms outperform small size

and high value firms, and small size and mid value firms outperform big size and mid value firms. Also, small size and low value firms outperform big size and low value firms. So, it may be concluded that overall, small size firms outperform big size firms, and we confirm the existence of size effect in the Indian stock market. It is similar to the outcomes of Fama and French (1993). The small size and low value firms outperform small size and high value firms. Also, big size and low value firms outperform big size and high value firms. So, we conclude that growth firms outshine distressed firms. It is in antithesis with the findings of Fama and French (1993).

Lastly, it may be concluded that in the Indian stock market, CAPM fails to capture the asset returns, though it may be a base for the researchers to develop another model or extend the same model. Some other theories from social sciences may also be explored as an alternative to the model because it is a mathematical model which holds true under certain conditions. Keeping in mind these facts, one may come to a point that CAPM is needed, dead or alive.

Research Implications, Limitations of the Study, & Scope for Further Research

Typical institutional investors keep the authority to win against a fixed standard. This mandate discourages the arbitrage process. In such a situation, the investors should not rely on a fixed standard and should always look for a deviation from the benchmark. Anomalies are the pragmatic out-turns that appear to be in conflict with the prolonged conjecture of asset pricing. The in-attendance piece of work confirms the presence of market risk anomaly in the Indian stock market. So, one may infer that the Indian stock market is a market place where one may bag abnormal returns. The study signals not to rely fully on CAPM - beta, but investors should also look for other variables or models to predict the price of the asset.

The study is based on NIFTY 50, which accounts for 65% of the market capitalization. The out-turns of the study may not reflect the entire market, although it may be regarded as a good representative of the market. The present piece of work covers the post-crisis period. Some authors claim that downsize-beta is a good representative of the price fluctuations.

Researchers may look for Fama and French three-factor as well as five-factor model as an extension of the prolonged CAPM. Researchers may also carry forward the research for other indices like NIFTY100, NIFTY 200, and NIFTY500, etc. Also, CAPM-beta for the crisis period may be put forward.

References

Abbas, Q., Ayub, U., Sargana, S. M., & Saeed, S. K. (2011). From regular-beta CAPM to downside-beta CAPM. *European Journal of Social Sciences, 21* (2), 189 - 203.

Abdymomunov, A., & Morley, J. (2011). Time variation of CAPM betas across market volatility regimes. *Applied Financial Economics, 21*(19), 1463 - 1478. DOI: https://doi.org/10.1080/09603107.2011.577010

Aggarwal, R. (2017). The Fama - French three factor model and the capital asset pricing model: Evidence from the Indian stock market. *Indian Journal of Research in Capital Markets, 4*(2), 36 - 47. DOI: 10.17010/ijrcm/2017/v4/i2/116087

Anwar, M., & Kumar, S. (2018). Sectoral robustness of asset pricing models: Evidence from the Indian capital market. *Indian Journal of Commerce and Management Studies, 9*(2), 42 - 50. doi: http://dx.doi.org/10.18843/ijcms/v9i2/05

Bajpai, S., & Sharma, A. K. (2015). An empirical testing of capital asset pricing model in India. *Procedia - Social and Behavioral Sciences, 189,* 259 - 265.doi: https://doi.org/10.1016/j.sbspra.2015.03.221

Baker, M., Bradley, B., & Wugler, J. (2011). Benchmarks as limits to arbitrage: Understanding the low volatility anomaly. *Financial Analysts Journal, 67* (1), 40 - 54. doi: https://doi.org/10.2469/faj.v67.n1.4

Barberis, N., Greenwood, R., Jin, L., & Shleifer, A. (2015). X-CAPM : An extrapolative capital asset pricing model. *Journal of Financial Economics, 115* (1), 1 - 24.doi: https://doi.org/10.1016/j.jfineco.2014.08.007

Basu, D., & Chawla, D. (2010). An empirical test of CAPM - The case of Indian stock market. *Global Business Review, 11* (2), 209 - 220. doi: https://doi.org/10.1177/09721509101100206

Brown, P., & Walter, T. (2013). The CAPM : Theoretical validity, empirical intractability and practical applications. *Abacus, 49* (S1), 44 - 50.doi: https://doi.org/10.1111/j.1467-6281.2012.00383.x

Da, Z., Guo, R. J., & Jagannathan, R. (2012). CAPM for estimating the cost of equity capital: Interpreting the empirical evidence. *Journal of Financial Economics, 103* (1), 204 - 220.doi : https://doi.org/10.1016/j.jfineco.2011.08.011

De Giorgi, E. G., Hens, T., & Levy, H. (2011). *CAPM equilibria with prospect theory preferences*. doi: http://dx.doi.org/10.2139/ssrn.420184

Fama, E.F., & French, K.R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics, 33* (1), 3 - 56. doi: https://doi.org/10.1016/0304-405X(93)90023-5

Fama, E. F., & French, K. R. (1996). The CAPM is wanted, dead or alive. *The Journal of Finance, 51* (5), 1947 - 1958. doi: https://doi.org/10.1111/j.15406261.1996.tb05233.x

Ho, W.R.J., Tsai, C.L., Tzeng, G.H., & Fang, S.K. (2011). Combined DEMATEL technique with a novel MCDM model for exploring portfolio selection based on CAPM. *Expert Systems with Applications, 38* (1), 16 - 25. doi: https://doi.org/10.1016/j.eswa.2010.05.058

Hwang, Y. S., Min, H. G., McDonald, J. A., Kim, H., & Kim, B. H. (2010). Using the credit spread as an option-risk factor: Size and value effects in CAPM. *Journal of Banking & Finance, 34* (12), 2995 - 3009. doi: https://doi.org/10.1016/j.jbankfin.2010.07.005

Levy, H. (2010). The CAPM is alive and well: A review and synthesis. *European Financial Management, 16* (1), 43 - 71.doi: https://doi.org/10.1111/j.1468-038X.2009.00530.x

Moosa, I. A. (2013). The capital asset pricing model (CAPM): The history of a failed revolutionary idea in finance? Comments and extensions. *Abacus, 49* (S1), 62 - 68.doi: https://doi.org/10.1111/j.1467-6281.2012.00385.x

Pandey, A., & Sehgal, S. (2016). Explaining size effect for Indian stock market. *Asia - Pacific Financial Markets, 23*(1), 45 - 68. doi : https://doi.org/10.1007/s10690-015-9208-0

Panwar, V. (2016). Testing the validity of capital asset pricing model (CAPM) in the Indian stock market. *Indian Journal of Research in Capital Markets, 3* (3), 49 - 56.

Patton, A. J., & Timmermann, A. (2010). Monotonicity in asset returns: New tests with applications to the term structure, the CAPM, and portfolio sorts. *Journal of Financial Economics, 98* (3), 605 - 625.doi: https://doi.org/10.1016/j.jfineco.2010.06.006

Shah, T.A. (2018). Risk parity approach: A thematic review of literature and research opportunities. *Indian Journal of Research in Capital Markets, 5* (3), 42 - 56. DOI: 10.17010/ijrcm/2018/v5/i3/138186

Smith, T., & Walsh, K. (2013). Why the CAPM is half - right and everything else is wrong. *Abacus, 49* (S1), 73 - 78.doi: https://doi.org/10.1111/j.1467-6281.2012.00387.x

Teplova, T., & Shutova, E. (2011). A higher moment downside framework for conditional and unconditional CAPM in the Russian stock market. *Eurasian Economic Review, 1* (2), 157-178. doi: https://doi.org/10.14208/BF03353829

Ward, M., & Muller, C. (2012). Empirical testing of the CAPM on the JSE. *Investment Analysts Journal, 76*, 1-12. doi : https://doi.org/10.1080/10293523.2012.11082546

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