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Disparities in Cost of Equity Estimation Among Estimation Models in the Indian Context

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Abstract

The purpose of this study is to bring out the disparities in the cost of equity of Indian companies estimated using the three asset pricing models such as the Capital Asset Pricing Model (CAPM), the Fama-French Three-Factor (FF3F) model and the Carhart four-factor model. The stock price data of 489 companies listed in the National Stock Exchange (NSE) from 2012 to 2019 (8 years) were used for estimating the cost of equity capital. The coefficients of the factors in the models were estimated applying Ordinary Least Square (OLS) regression method. One-Way ANOVA was used to examine the group wise differences in the cost of equity. The computed cost of equity of Indian companies significantly differs among the three estimation models. Further, significant differences in the cost of equity were observed across industries in all three estimation models. Market capitalization-wise, differences in cost of equity were found as per CAPM and FF3F model. But no such differences were found in the case of Carhart four-factor model. Sector-wise analysis doesn't show differences in the cost of equity.

Keyword: Asset Pricing Models; Capital Asset Pricing Model; Fama-French Three-Factor Model; Carhart Four - Factor Model.

INTRODUCTION

Asset pricing models have been extensively discussed in financial literature and it is a core area of research in finance. These models are used for different purposes such as estimation of cost of capital, evaluation of portfolios, estimating the informational efficiency of asset markets etc. Among these, determination of the cost of equity is one of the major challenges in finance and accounting literature. The great concern in this area has contributed to developing different methods over the years.[1,2] Sharpe[3] and Lintner[4] introduced the Capital Asset Pricing Model (here after CAPM), which marks the birth of the asset pricing theory. Here the expected return of an asset is the sum of the return from risk-free asset and market risk premium. It was a strong model used by investors, practitioners, academicians and valuation experts because of its simplicity and stability.[5,6] At the same time, researchers have raised doubts about the validity of CAPM and many disputes have occurred. Studies reported that the average security

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return could not be explained by the beta factor alone. Company characteristics like value effect and size effect are not captured by this beta factor. The CAPM gradually lost its significance due to empirical contradictions.[5,7-10]

To address these issues, Fama and French[11] published a seminal paper that introduced the multi-factor asset pricing model, which explained the stock returns better than CAPM. This model is comprised of two additional explanatory factors beyond the stock market factor to explain the cross-sectional mean return on stocks better. Size (SMB) and value (HML) factor are the two factors in the Fama-French Three-Factor (here after FF3F) model where size is measured by market capitalization and value is measured by book equity to market equity.[2,12-15] Later, the FF3F model became the benchmark for asset pricing and sufficient empirical evidence was reported in favor of this model. However, there are several unearthed stock market factors such as momentum, profitability, accruals, liquidity, asset growth and quality. The FF3F model does not explain these anomalies. As a result, it is not a perfect solution for asset pricing. In addition to that, the methods for constructing SMB and HML factors in the FF3F model are derived empirically and it lacks a solid theoretical foundation.[7,10] Therefore, the application of the three-factor model is interesting for research; simultaneously, its implementation into policy is problematic.[7,15] Subsequently, Carhart[16] suggested a four-factor model with a momentum factor that extends the FF3F model. This model performs better than the CAPM and it became the standard model for asset pricing.[17,18]

In most of the studies, asset pricing models are empirically tested in developed markets and such type of studies are relatively less in Asian emerging markets. Literature reports are trying to interpret the predictability of stock returns using these models, but still, there is a significant gap in the literature regarding the best factor model. Therefore it is an unsolved puzzle in the Indian context.[19]

The present study estimates the cost of equity of NSE listed 489 companies using CAPM, FF3F model and Carhart four-factor model and analysis is based on market capitalization, industry-wise and sector-wise. The paper is structured as follows: Section 2 deals with the literature review, section 3 introduces the methodology and materials and section 4 presents results and discussions followed by the conclusion.

Literature Review

Khudoykulov[19] evaluated three popular asset pricing models, i.e., CAPM, FF3F model and Fama-French five-factor model in the Indian context and found the inferior performance of the single factor model while explaining the stock return relative to two other models. Zaremba *et al.*[20] examined the performance of four asset pricing models such as CAPM, FF3F model, Carhart four-factor model and five-factor model in the Polish stock market and reported that the four-factor asset pricing model outperforms the latter three models. Sreenu[21] tested the validity and reliability of CAPM and the three-factor model during a period of seven years in the Indian stock market and concluded that the three-factor model has the potential to provide a better explanation to the variation in the stock rate of return. Xu and Zhang[22] investigated the Fama French model in the Chinese stock market and found that more than 93% of the portfolio variance can be explained by the three-factor model. FF3F model is more efficient in predicting a return on portfolios compared to CAPM in the Indian context.[23]

Nartea *et al.*[24] compared the performance of the CAPM, FF3F model and Carhart four-factor model in the New Zealand stock market. The result showed that cost of capital estimation would be more accurate while using the Carhart four-factor model instead of CAPM and FF3F model. Taneja[25] investigated the CAPM and FF3F model in the Indian capital market by examining a sample of 187 companies and reported that the FF3F model describes the differences in returns compared to CAPM. FF3F model explained the variations in stock returns better than CAPM to the BRVM stock market.[26] Another study[2] also inferred that the FF3F model might be used in the estimated return calculation for firms listed in the Johannesburg Stock Exchange (JSE).

Empirical studies in the area of asset pricing models mainly focused on identifying the factors which explain stock return effectively. As a result, the authors incorporated new factors on the asset pricing equation and it leads to the development of different models. The validity of these models has been tested both in the developed as well as developing markets. The return expectation of the equity shareholders changes over time. This dynamism in the behavior of equity shareholders demands the calculation of expected return on equity on a continuous basis. This article attempts to estimate the cost of equity using three popular asset pricing models and also examines the differences in cost of equity computation of companies based

on market capitalization such as small cap, mid cap and large-cap and investigate sectoral and industrial variations in the cost of equity. The following hypotheses were developed based on the reviews.

H_1: The computed cost equity can be different among the estimation models.

H_2: The computed cost of equity differs significantly within each estimation model based on the market capitalization, nature of the industry and the company sector.

METHODOLOGY AND MATERIALS

The empirical study computed the cost of equity of companies in India using CAPM, FF3F model and Carhart four-factor model. A sample of 500 companies was chosen from the NSE listed companies. However, only 489 companies were considered finally as the rest were outer layers, thus excluded. The study period spans from January 2012 to December 2019 and it yields 96 monthly observations. Monthly adjusted closing prices were used for calculating the monthly stock returns for the sample companies and which were obtained from *yahoofinance.com*.

The monthly rate of returns was calculated from the following equation 1.

Rate of return = $(P_1 - P_0 + D_1)/ P_0$ (Eq.1)(Hirt & Block, 2012)[27]

P_1 = Price at the end of the period

P_0 = Price at the beginning of the period

D_1 = Dividend income

Cost of capital computation using these models requires data for risk-free rate, market risk premium, SMB, HML, WML and it is sourced from Kenneth and French data library for the Indian market.[28] All these factors were averaged from 2012 to 2019 for calculating the cost of equity. After running ordinary least square regression using equations 2, 3 and 4, coefficients of these factors were obtained, and the monthly cost of equity was computed and then converted into annually. The cost of equity estimated was analyzed in different forms based on market capitalization, industry-wise and sector-wise. Hypotheses were tested using a one-way Analysis of Variance (ANOVA).

Model Specification

To test three asset pricing models following regression models were used:

CAPM: $R_t - R_{ft} = \alpha + \beta_1(R_{mt} - R_{ft}) + \varepsilon_t$ (Eq.2)[3,4]

FF3F model: $R_t - R_{ft} = \alpha + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \varepsilon_t$ (Eq.3)[11]

Carhartfour-factormodel: $R_t - R_{ft} = \alpha + \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \varepsilon_t$ (Eq. 4)[16]

Where subscript t denotes the time period, R_t is the return on stock prices, R_{ft} is the risk-free rate, R_{mt} is the return on the market index, SMB is the return on a portfolio of small stocks minus the return on a portfolio of large stocks, HML is the return on a portfolio of stocks with high book to market values minus the return on a portfolio of stocks with low book to market values, WML represent the excess return of positive over negative momentum stocks, β1, β2 and β3 are the slope coefficients and Σ_t is the random disturbance term. The dependent variable is the cost of equity and the independent variables are market risk premium, SMB, HML and WML.

After having the estimate, the following equations 5, 6 and 7 were used for computing the cost of equity.

CAPM: $E(R) = R_f + \beta_1(R_m - R_f)$ (Eq.5)

FF3F model: $E(R) = R_f + \beta_1(R_m - R_f) + \beta_2 SMB + \beta_3 HML$ (Eq.6)

Carhartfour-factormodel: $E(R) = R_f + \beta_1(R_m - R_f) + \beta_2 SMB + \beta_3 HML + \beta_4 WML$ (Eq.7)

The profile of the sample is given in Table 1 and Table 2 respectively.

Table 1: Classification of sample firms according to Market capitalization and Sectors

Market capitalization			Sectors		
Categories	**No. of companies**	**Percentage to Total**	**Categories**	**No. of companies**	**Percentage to Total**
Large cap	50	10%	Primary	11	2%
Mid cap	74	15%	Secondary	347	71%
Small cap	365	75%	Tertiary	131	27%
Total	489	100	Total	489	100

Table 1 exhibits the classification of companies based on market capitalization and distinct sectors. According to market capitalization, small cap companies account for 75% of the total 489 companies compared to 15% and 10% for mid cap and large cap companies. The primary sector accounts for only 2% of all companies, while the secondary and tertiary sectors were 71% and 27% respectively.

Table 2: Industry-wise classification of sample firms

Industry	No of companies	% to Total
Banking and Finance	50	10%
Automobiles and Ancillaries	35	7%
Pharmaceuticals and Healthcare	27	5%
Technology	36	7%
Energy	27	6%
Engineering	84	17%
Services	40	8%
Real Estate	17	4%
Transportation	5	1%
Agriculture and Horticulture Lives	5	1%
Consumer Products	97	20%
Chemicals	34	7%
Metals and Mining	14	3%
Paper/Glass/Plastic	18	4%
Total	489	100

Table 2 categorizes the sectors into 14 industry groups. It can be seen that consumer products are the largest industry in terms of the number of companies (97 companies), accounting for 20% of the total. Engineering (17%) was the second-largest industry with 84 companies and the third-largest industry was banking and finance (10%). The services industry accounts for 8% of the total, while the other three sectors, automobiles and ancillaries, technology and chemicals, each account for 7%. The remaining industries account for less than 5% of the total.

RESULTS AND DISCUSSION

Cost of equity – All companies

Our final sample consists of 489 firms. The summary statistics associated with the cost of equity estimation across three different methods were reported in Table 3.

Table 3: Cost equity – All companies

Categories	Mean	Standard deviation	Skewness	Kurtosis
FF3F	11.62	3.03	-0.03	-0.27
Carhart	11.35	6.12	0.31	-0.33
CAPM	13.90	2.95	-0.05	-0.39

Table 3 reports the results of summary statistics of cost of equity. CAPM has the highest average cost of equity of 13.90% that deviates within the range of 2.95% followed by the FF3F model with a mean average cost of equity of 11.62% that varied over the range of 3.03%. Carhart four-factor model has the lowest average cost of equity of 11.35% with a standard deviation in the range of 6.12%. The skewness of cost of equity is in the range of - 1 and + 1 inferring that the distributions are normal (Groeneveld & Meeden, 1984).[29] The negative kurtosis value indicated that the tails of the distributions are thinner and the center of the distributions are thicker.

One way-ANOVA was conducted for identifying the significance of the difference in cost of equity estimation using three estimation models. Results were reported in Table 4.

Table 4: One-way ANOVA result

	Sum of squares	df	Mean square	F	Sig.
Between groups	1911.9	2	955.952		
Within groups	27003.87	1464	18.445	51.83	0.000
Total	28915.78	1466	-		

Notes: Significant at the 5 percent level

The results of the one-way ANOVA test are stated in Table 4. The result allowed to reject the null hypothesis. There was a significant difference in the cost of equity estimation of companies across three models (F= 51.83, p= 0.000).

Cost of equity – Industry-wise

The summary statistics associated with the cost of equity capital of different industries using three different methods was reported in Table 5.

Table 5: Cost of equity – Industry-wise

Categories	Industry	N	Mean	Minimum	Maximum
	Banking and Finance	50	12.62	4.78	17.57
	Automobiles and Ancillaries	35	12.56	5.03	18.53
	Pharmaceuticals and Healthcare	27	10.38	4.45	17.11
	Technology	36	11.11	4.06	19.36
	Energy	27	11.1	4.06	18.27
	Engineering	84	12.23	3.92	18.61
FF3F	Services	40	10.94	4.3	18.68
	Real Estate	17	11.64	7.56	17.92
	Transportation	5	12.94	9.94	16.56
	Agriculture and Horticulture Lives	5	12.02	7.98	15.9
	Consumer Products	97	11.05	4.83	18.52
	Chemicals	34	11.63	5.85	17.02
	Metals and Mining	14	11.17	5.11	14.85
	Paper/Glass/Plastic	18	12.18	5.84	17.13
	Total	489	11.62	3.92	19.36
	Banking and Finance	50	9.87	0.38	26.97
	Automobiles and Ancillaries	35	11.85	3.47	23.88
	Pharmaceuticals and Healthcare	27	9.8	0.64	17.3
	Technology	36	13.78	2.26	28.07
	Energy	27	10.57	1.06	24.61
	Engineering	84	10.62	1.29	25.94
	Services	40	9.77	0.26	24.89
CARHART	Real Estate	17	11.03	2.74	27.54
	Transportation	5	11.12	6.3	18.23
	Agriculture and Horticulture Lives	5	11.77	6.82	19.45
	Consumer Products	97	12.31	0.8	27.83
	Chemicals	34	12.31	0.68	28.49
	Metals and Mining	14	10.07	0.39	26.86
	Paper/Glass/Plastic	18	14.4	1.84	26.2
	Total	489	11.35	0.26	28.49
	Banking and Finance	50	15.22	7.68	19.97
	Automobiles and Ancillaries	35	14.45	7.02	21.58
	Pharmaceuticals and Healthcare	27	11.29	6.13	16.47
	Technology	36	12.48	7.18	19.16
	Energy	27	13.4	9.07	18.55
	Engineering	84	15.23	9.87	20.61
	Services	40	13.48	6.92	20.9
	Real Estate	17	13.4	8.65	19.17
CAPM	Transportation	5	14.17	10.9	17.93
	Agriculture and Horticulture Lives	5	13.94	11.32	17.64
	Consumer Products	97	13.38	7.04	20.46
	Chemicals	34	14.3	9.52	19.28
	Metals and Mining	14	14.41	9.5	16.98

table cont....

Paper/Glass/Plastic	18	13.33	7.96	17.33
Total	489	13.9	6.13	21.58

In Table 5 the results of summary statistics of cost of equity in 14 different industries was discussed. The average cost of equity reasonably varies across industries in FF3F model as well as CAPM, whereas in the Carhart four-factor model, a considerable amount of differences could be observed. The highest average cost of equity in the FF3F model occurred in the transportation industry (12.94%) followed by banking and finance (12.62%) and automobiles and ancillaries (12.56%). Whereas, the average cost of equity was reported the lowest in the pharmaceuticals and healthcare industry (10.38%) followed by services industry (10.94%) and consumer products industry (11.05%).

In the Carhart four-factor model, the highest average cost of equity was reported in paper/glass/plastic industry (14.41%), which was followed by technology (13.78%), consumer products (12.31%) and chemical industry (12.31%) respectively. In CAPM, the highest average cost of equity was outlined in the engineering industry (15.23%), followed by banking and finance industry (15.22%) as well as automobiles and ancillaries (14.45%) in the row. The maximum cost of equity was noticed in the chemical industry for both the FF3F model (19.36%) as well as the Carhart four-factor model (28.49%). While considering the FF3F model, the cost of equity has marked the minimum in the engineering industry (3.92%).

On the other hand, Carhart four-factor model has recorded the minimum cost of equity in the banking and finance industry (0.38%). In contrast, CAPM has the maximum cost of equity in the automobiles and ancillaries (21.58%) industries, while minimum in the pharmaceuticals and healthcare (6.13%).

The assumption of equality of variances underpins the one-way ANOVA test. Levene's test statistics have been used to ensure the variances were equal. As per Levene's test statistics equal variances were reported in all three models (FF3F model (F= 0.316, p = 0.990), Carhart four - factor model (F= 0.737, p = 0.727) and CAPM (F = 1.229, p = 0.255)). Therefore, Standard one way-ANOVA was conducted in all three cases. Results were reported in Table 6.

Table 6: One-way ANOVA results based on Industry

Methods	df	F	Sig.
FF3F	(13,475)	2.066	0.015
CARHART	(13,475)	1.827	0.037
CAPM	(13,475)	5.599	0.000

Table 6 reports the results of one-way ANOVA test conducted between different industries. The results reflect the significant differences that were observed between these industries in all the three models (FF3F model (F(13,475) =2.066, p = 0.015), Carhart four-factor model (F (13,475) = 1.827, p=0.037) and CAPM(F (13,475) = 5.599, p = 0.000)).

Cost of equity – Sector-wise

The summary statistics of the cost of equity in three sectors for three different models were given in Table Table 7.

Table 7: Cost of equity – Sector-wise

Methods	Sectors	N	Mean	Minimum	Maximum
FF3F	Primary	11	11.09	7.59	15.9
	Secondary	347	11.61	3.92	18.61
	Tertiary	131	11.69	4.06	19.36
	Total	489	11.62	3.92	19.36
CARHART	Primary	11	12.7	5.23	19.45
	Secondary	347	11.46	0.39	28.49
	Tertiary	131	10.96	0.26	28.07
	Total	489	11.35	0.26	28.49

CAPM	Primary	11	14.25	11.32	17.64
	Secondary	347	13.91	6.13	21.58
	Tertiary	131	13.84	6.92	20.9
	Total	489	13.9	6.13	21.58

Table 7 displays the summary statistics of the cost of equity for various sectors using three different models. It can be seen that the average/mean cost of equity for all sectors was around 11% in FF3F model whereas it was different in Carhart four-factor model and CAPM. The CAPM had a higher average cost of equity than FF3F and Carhart four-factor models and the values were 14.25%, 13.91% and 13.84% for primary, secondary and tertiary sectors respectively.

The minimum cost of equity reported was in secondary sector for FF3F model and CAPM and were 3.92% and 6.13% respectively. According to the Carhart four-factor model, the tertiary sector has the lowest cost of equity at 0.26%. The maximum cost of equity reported in FF3F model was in the tertiary sector (19.36%). However, the maximum cost of equity reported in Carhart four-factor model and CAPM was in the secondary sector and were 28.49% and 21.58%, respectively.

As per Levene's test statistics equal variances were reported in FF3F model (F= 0.921, p =0.399) and Carhart four-factor model (F = 0.389, p = 0.678) and hence standard one-way ANOVA was used. Levene's statistics showed unequal variance in CAPM (F=4.168, p = 0.016), so Welch ANOVA was used.

The obtained results were given in Table 8 and Table 9 respectively.

Table 8: One-way ANOVA results based on different sectors

Methods	df	F	Sig.
FF3F	(2,486)	0.204	0.815
CARHART	(2,486)	0.587	0.556

Table 8 lists the results of one-way ANOVA test. There was no statistically significant difference between groups as determined by one-way ANOVA in both FF3F model (F(2,486) = 0.204, p = 0.815) and Carhart four-factor model (F (2,486) = 0.587, p = 0.556).

Table 9: Welch ANOVA results based on different sectors

Method	Statistic	df1	df2	Sig.
CAPM	0.227	2	28.482	0.799

The results of welch ANOVA were reported in Table 9. As seen in earlier cases, there was no statistically significant difference between the primary, secondary and tertiary sectors, as indicated by p-value greater than 0.5 (F (2, 28.482) = 2.589, p = 0.799).

Cost of equity – Market cap-wise

As per Levene's test statistics, equal variances were reported both in FF3F model (F = 0.822, p = 0.440) and CAPM (F = 0.91, p = 0.403). In the first two cases, standard one-way ANOVA test was performed. However, in the Carhart four-factor model test statistic indicated unequal variance (F=3.28, p = 0.038) and it was subjected to welch ANOVA test.

Results were given respectively in Table 10 and Table 11.

Table 10: One-way ANOVA results based on market capitalization

Methods	df	F	Sig.
FF3F	(2,486)	3.151	0.044
CAPM	(2,486)	30.193	0.000

Table 10 shows the results of one-way ANOVA based on the market capitalization of companies. Market capitalization wise, differences in cost of equity were found as per FF3F model (F(2,486) = 3.151, p = 0.044) and CAPM(F (2,486) = 30.193, p = 0.000).

Table 11: Welch ANOVA results

Method	Statistic	df1	df2	Sig.
CARHART	2.589	2	108.203	0.080

Table 11 shows the results of the welch ANOVA. There were no differences in the cost of equity for Carhart four-factor model (F (2, 108.203) = 2.589, p = 0.080).

CONCLUSION

In summary, The empirical study estimated the cost of equity of Indian companies listed on the NSE using CAPM, FF3F model and Carhart four-factor model for a period of eight years from 2012 to 2019. The key finding of the study is that the computed cost of equity significantly differs among the estimation models. The results will aid practical

finance managers in making capital budgeting decisions and investors in portfolio planning and revision. The maximum cost of equity for most industries was above 20% in the Carhart four-factor model. This high cost of capital may cause heavy pressure on the financial managers, as it forces them to identify the projects or investments that provide high returns to meet the expectations of investors. A few companies show the cost of equity above 20% as per CAPM. But none of the companies shows a cost of capital exceeding 20% in the FF3F model. The average cost of equity differs moderately across industries while applying FF3F model and CAPM. However, the average cost of equity varied to a greater degree for industries in Carhart four-factor model.

REFERENCES

1. Laghi E, Di Marcantonio M. Beyond CAPM: estimating the cost of equity considering idiosyncratic risks. Quant Finance. 2016 Aug 2;16(8):1273–96.
2. Basiewicz PG, Auret CJ. Feasibility of the fama and french three factor model in explaining returns on the JSE. Investment Analysts Journal. 2010;71(1):13–25.
3. Sharpe WF. CAPITAL ASSET PRICES: A THEORY OF MARKET EQUILIBRIUM UNDER CONDITIONS OF RISK. J Finance. 1964;19(3):425–42.
4. Lintner J. The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets [Internet]. Vol. 47. 1965. Available from: https://about.jstor.org/terms.
5. Galagedera DUA. A review of capital asset pricing models. Managerial Finance. 2007 Sep 4;33(10):821–32.
6. Moyo V. Inferring The Cost Of Equity: Does The CAPM Consistently Outperform The Income And Multiples Valuation Models? Vol. 34, The Journal of Applied Business Research.
7. Bornholt G. Extending the capital asset pricing model: The reward beta approach. Vol. 47, Accounting and Finance. 2007. p. 69–83.
8. Lee S, Upneja A. Is Capital Asset Pricing Model (CAPM) the best way to estimate cost-of-equity for the lodging industry? International Journal of Contemporary Hospitality Management. 2008;20(2):172–85.
9. Chiah M, Chai D, Zhong A, Li S. A Better Model? An Empirical Investigation of the Fama–French Five-factor Model in Australia. International Review of Finance. 2016 Dec 1;16(4):595–638.
10. Lalwani V, Chakraborty M. Multi-factor asset pricing models in emerging and developed markets. Managerial Finance. 2020 Mar 19;46(3):360–80.
11. Fama EF, French KR. Common risk factors in the returns on stocks and bonds*. Vol. 33, Journal of Financial Economics. 1993.
12. Gaunt C. Size and book to market effects and the Fama French three factor asset pricing model: evidence from the Australian stockmarket. Vol. 44, Accounting and Finance. 2004.
13. Faff R. A simple test of the Fama and French model using daily data: Australian evidence. Applied Financial Economics. 2004 Jan 15;14(2):83–92.
14. Simpson MW, Ramchander S. An inquiry into the economic fundamentals of the Fama and French equity factors. J Empir Finance. 2008 Dec;15(5):801–15.
15. Vo DH. Which Factors Are Priced? An Application of the Fama French Three-Factor Model in Australia. Economic Papers. 2015 Dec 1;34(4):290–301.
16. Carhart MM. On persistence in mutual fund performance. Journal of Finance. 1997;52(1):57–82.
17. Garyn-Tal S, Lauterbach B. The formulation of the four factor model when a considerable proportion of firms is dual-listed. Emerging Markets Review. 2015 Sep 1;24:1–12.
18. Rath S, Durand RB. Decomposing the size, value and momentum premia of the Fama-French-Carhart four-factor model. Econ Lett. 2015 Jul 1;132:139–41.
19. Khudoykulov K. Asset-pricing models: A case of Indian capital market. Cogent Economics and Finance. 2020 Jan 1;8(1).
20. Zaremba A, Czapkiewicz A, Szczygielski JJ, Kaganov V. An Application of Factor Pricing Models to the Polish Stock Market. Emerging Markets Finance and Trade. 2019 Jul 15;55(9):2039–56.
21. Sreenu N. An Empirical Test of Capital Asset-pricing Model and Three-factor Model of Fama in Indian Stock Exchange. Management and Labour Studies. 2018 Nov 1;43(4):294–307.
22. Xu J, Zhang S. The Fama-French Three Factors in the Chinese Stock Market. China Accounting and Finance Review. 2014 Jul;16(2).
23. Sehgal S, Balakrishnan A. Robustness of Fama-French Three Factor Model: Further Evidence for Indian Stock Market. Vision: The Journal of Business Perspective. 2013 Jun;17(2):119–27.
24. Nartea G V., Ward BD, Djajadikerta HG. Size, BM, and momentum effects and the robustness of the Fama-French three-factor model: Evidence from New Zealand. International Journal of Managerial Finance. 2009 Apr 3;5(2):179–200.

25. Pal Taneja Y. Arumugam (1996) showed market anomaliesfor CAPM Fama French. Jagadeesh. Bhandari; 1977.

26. Soumaré I, Aménounvé EK, Diop O, Méité D, N'Sougan YD. Applying the CAPM and the Fama-French models to the BRVM stock market. Applied Financial Economics. 2013 Feb;23(4):275–85.

27. Hirt GA, Block SB. Fundamentals of investment management. New York: Mcgraw-Hill/Irwin; 2012.

28. Fama French and Momentum Factors: Data Library for Indian Market [Internet]. 2023 [cited 2020 May 25]. Available from: https://faculty.iima.ac.in/~iffm/Indian-Fama-French-Momentum/.

29. Groeneveld RA, Meeden G. Measuring Skewness and Kurtosis [Internet]. Vol. 33, Source: Journal of the Royal Statistical Society. Series D (The Statistician). 1984. Available from: https://about.jstor.org/terms.