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ASSET PRICING ANOMALIES: COMPARATIVE PERFORMANCE OF CAPM, FF3FM, AND FF5FM IN THE INDIAN EQUITY MARKET

Abstract

This study evaluates asset pricing models in India, highlighting the superiority of the Fama-French Three-Factor Model over CAPM while questioning the added value of the Fama-French Five-Factor Model. The findings offer insights for investors and policymakers in portfolio management and asset allocation. The study evaluates and compares the performance of asset pricing models – Single-Factor Model of Sharpe and Linter, Three-Factor Model of Fama and French, and Five-Factor Model of Fama and French– on the Indian stock market. It employs the Fama-French methodology to analyze asset pricing. This paper uses four characteristics of a firm to test the market capitalization model for the size effect, the book-to-price ratio for the value effect, the net income to book equity ratio as a variable of profitability effect, and annual growth of total assets for the investment effect. Spanning nine years from July 1, 2012 to June 30, 2021, this study examines 64 companies from the NSE 100 index to analyze stock return dynamics. This study provides a comprehensive comparison of the three models using 18 (6 x 3) portfolios constructed based on size, value, profitability, and investment. The study found that the Fama-French Three-Factor Model, with an R^2 of 95.6%, outperformed the Capital Asset Pricing Model, which had an R^2 of 89.9%. Although the Fama-French Five-Factor Model achieved the highest R^2 of 95.8%, its improvement over FF3FM was minimal. This indicates that the inclusion of profitability and investment factors does not significantly enhance the model's ability to explain stock returns.

Keywords value, profitability, investment, equity market

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INTRODUCTION

In empirical asset pricing, understanding the cross-sectional variation in expected stock returns remains one of the most enduring and unresolved challenges. Despite decades of research, the precise factors that systematically drive returns continue to elude consensus, prompting an ongoing debate among academics and practitioners alike. The traditional Capital Asset Pricing Model by Sharpe (1964), Lintner (1965), and Mossin (1966) was an early attempt to address this issue, positing market risk as the sole determinant of expected returns. However, empirical evidence has persistently contradicted its predictions, giving rise to multifactor models such as the Fama-French Three-Factor Model (1993), which introduced size and value factors in addition to market risk.

Subsequent extensions, including the Fama-French Five-Factor Model (2015), incorporated profitability and investment factors to further account for anomalies that could not be explained by earlier models. Nonetheless, even these expanded models exhibit shortcomings – most notably, the persistent weak explanatory power of the value fac-

tor (HML). This highlights a deeper scientific problem: which combination of risk factors provides the most robust and comprehensive explanation of the cross-section of expected returns?

This variability challenges the theoretical foundations of asset pricing models and raises questions about whether the inclusion of additional factors genuinely enhances explanatory power or merely reflects overfitting. The scientific problem at the core of this study, therefore, concerns the systematic evaluation of competing multifactor models, particularly in terms of their robustness, parsimony, and empirical consistency across diverse portfolio structures.

1. LITERATURE REVIEW AND HYPOTHESES

Since its initial discussion by Markowitz in 1952, the study of stock and portfolio prices in terms of their return (growth or decrease in price) and risk (variability in return) has been a favorite among scholars. By incorporating the risk-free asset into the study, Tobin (1958) expanded Markowitz's work. Given that a risk-free asset has no standard deviation and no connection in returns with a risky portfolio. The positive Capital Asset Pricing Model (CAPM) of Sharpe (1964), Lintner (1965), and Mossin (1966) addressed the question of what an asset's price should be in relation to its underlying risk. Black et al. (1972) made an appropriate generalized variation of this model. Sharpe and Cooper (1972) tested CAPM on US stocks and said that high beta stock has a high return in the future. Fama and MacBeth (1973) have shown that when it comes to equilibrium conditions, Black's (1972) zero-Beta model of CAPM is more reliable than Sharpe's (1964) standard CAPM. The intertemporal capital asset pricing model (ICAPM), a logical progression of CAPM, was created by Merton in 1973 to place individual decision-making in a context where investors could maximize their wealth. An alternative to the CAPM for describing a portfolio's expected returns is the Arbitrage Pricing Theory (APT), which was created by Ross in 1976. Roll (1977) criticized it for the market portfolio's lack of observation. He raised severe concerns about the testability and its applicability in the absence of knowledge of the genuine market portfolio. In a real-world scenario, the market portfolio would include every possible security or almost anything with marketable value. A completely diverse market portfolio cannot be built or observed since returns on all potential assets are not observable. Because of its static beta, the CAPM also received criticism for producing inaccurate findings.

The Conditional CAPM (CCAPM), developed by Jagannathan and Wang in 1996, is an improvement on the CAPM that considers the time-varying nature of beta. However, it introduced multiple factors as key contributors to a security's risk, influencing risk premiums in asset pricing. Several authors have found other factors influencing average stock returns. The size effect was found by Banz in 1981. Basu (1983) found that average returns and earnings-to-price were positively correlated. Two investment techniques based on BE/ME and particular stock return reversal were tested by Rosenberg, Reid, and Lanstein (1985). Their study suggested buying stocks of a high BE/ME ratio and selling the stocks of a low BE/ME ratio, while specific stock return reversal is again an investment strategy that calculates return on stocks for the previous month and its relation with stock market factors. They found the strategies to be profitable and viable. Bhandari (1988) found that leverage has a positive relationship with average return. Chan et al. (1991) documented the value impact. Chan et al. (1991) found differences in stock returns for the Japanese context. They used proxies for the market and non-market variables such as size, P/E, BE/ME, and cash yield. They also found that BE/ME is paramount as it outperforms other variables in terms of statistical and economic significance. To explain significant return patterns, Fama and French (1993, 1996) rejected the CAPM and created their own three-factor asset pricing model with two additional factors: the size impact (market capitalization as a size variable) and the value effect (book equity to market equity as a value variable). The momentum approach was discovered by Jegadeesh and Titman (1993). In 1995, Loughran and Ritter (1995) discovered the anomaly of net stock issues. The accrual anomaly was documented by Sloan (1996). He investigated the idea that future expected returns cannot be predicted by a single factor (beta), and that cash flow and accrual data should be taken

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into account. Chan et al. (1998) evaluated different factors that include fundamental, technical, macroeconomic, statistical, and market factors in capturing stock returns variations. They documented that the fundamental factors, namely, size coupled with BE/ME, capture the covariations of stock returns. The Fama-French model was validated in India by Connor and Sehgal (2001), who also discovered that market beta, size, and value all had a significant impact on stock returns. According to Bahl (2006), the three-factor FF model outperformed its variations and the CAPM in explaining the cross-section of returns in the portfolio. A few novel anomalies, including net stock issuance, accruals, momentum, asset growth, and profitability, were tested by Fama and French (2008). Average stock returns and net stock issues, accruals, and momentum anomalies were shown to be significantly correlated, but the other two anomalies were found to be less significant. Cooper et al. (2008) revealed that firms making moderate investments in total assets yield risk-adjusted returns more than those of firms investing aggressively in total assets. Their study also documented that firm asset growth dominates other underlying variables, namely, market capitalization (MC), book-to-market equity, accruals, momentum, net stock issuance, and buy-back effects in terms of predicting future stock returns. To confirm that the CAPM and the three-factor model of FF can accurately interpret the cross-section of returns on the Indian stock market, Taneja (2010) evaluated the Fama-French three-factor model on the Indian stock market. He showed that the FF3F model was superior to CAPM. Sehgal et al. (2012) found that size, value, accruals, and net stock issues are positively related to stock returns, while profitability is negatively related to stock returns. They further documented that the Fama-French model captures average returns on portfolios constructed based on the above measures. Fama and French (2012) tested the integration between stock returns and three major stock return anomalies of size, BE/ME, and momentum for four world regions. The study sheds light that there are value premiums (BE/ME effect) in stock returns in all four regions, while strong momentum effects are found everywhere except Japan. According to Sehgal and Balakrishnan (2013), the abnormal returns lost by CAPM cannot be adequately explained by the three-factor FF model.

Nevertheless, it was discovered that the three-factor FF model was unable to adequately account for the changes in returns associated with investment and profitability. According to Novy-Marx (2013), the book-to-market ratio and gross profitability were equally effective in explaining variations in average stock returns. According to Hou et al. (2015), investment and profitability were significant factors in explaining variance in returns. Inspired by the results, Fama and French in 2015 expanded the three-factor model to include two more variables: investment and profitability, creating a five-factor asset pricing model. The five-factor model's asset pricing results demonstrated that the methodology could accurately predict the average excess returns on portfolios that combined size-value, size-profitability, and size-investment. Fama and French (2015) also documented that the FFTF model has become redundant in explaining the average returns on portfolios.

Hence, testing an economic model like asset pricing is not only confined to mature markets but also to be experimented with in emerging markets like India. The Fama-French five-factor model was deemed credible by Balakrishnan et al. (2018) because it explained portfolio returns that the FF three-factor model could not. When comparing the FF three-factor model to the FF five-component model, Khurshid (2020) showed that the single-factor CAPM performed poorly in explaining the differences in average stock returns.

This study evaluates the suitability of the Fama-French Five-Factor Model (FF5FM) for the Indian stock market and compares its performance against the Three-Factor Model (FF3FM) and the Capital Asset Pricing Model (CAPM) using data from 2012 to 2021.

Research hypotheses are as follows:

H1: The Fama-French Three-Factor Model (FF3FM) provides a better explanation of stock returns in the Indian market than the Capital Asset Pricing Model (CAPM).

H2: The Fama-French Five-Factor Model (FF5FM) improves explanatory power over FF3FM by incorporating profitability (RMW) and investment (CMA) factors.

H3: The profitability factor (RMW) and investment factor (CMA) do not significantly enhance the explanatory power of asset pricing models in the Indian stock market.

H4: The size factor (SMB) is a dominant predictor of stock returns, with small-cap stocks generating higher excess returns than large-cap stocks.

2. DATA AND METHODOLOGY

The current study is predicated on the Nifty 100 index firms' month-end values. The sample companies are part of the NIFTY 100, which is a wide stock index covering 17 industries. The NIFTY 100 is an index that tracks the combined performance of the NIFTY 50 and NIFTY Next 50 indexes. Over 70% of India's market capitalization and daily trading volume is made up of these sample firms. July 2012 to June 2021 is the sample period. Nevertheless, 36 companies were removed from the final data set because of insufficient data for some securities. 64 companies' month-end adjusted closing share prices cover the period from July 2012 to June 2021. The Indian fiscal year begins on April 1st, yet the portfolios for that month have not been created. Since it takes time for firm data to become accessible for analysis and to reach the market, a three-month lag was instead observed.

From July 2012 to June 2021, the month-end adjusted closing share price data have been converted into return data. As a monthly return series, a total of 108 observed returns were recorded for these 64 equities.

As a highly watched figure and the bellwether indicator of the Indian economy, the Nifty 50 is being utilized as a proxy for the market, and as such, its monthly closing value is converted into a series of monthly returns. T-bills, with a maturity date of 91 days, have been taken from the RBI website and utilized as a risk-free proxy. Since 91-day T-bills were only accessible on a weekly basis, an average of the weekly data was used to convert it to monthly data for comparability.

For the Capital Asset Pricing Model (CAPM), Beta (b) is calculated via a basic regression analysis. The purpose of this study is to regress the excess returns of a cross-sectional portfolio with equal weights over a period of 108 months, in relation to the excess returns of Nifty 50 over and above the monthly T-Bill (91 days). Within this regression analysis, the excess cross-section portfolio returns serve as the dependent variable, while the excess market returns function as the independent variable.

The equation is

$$R_i - R_f = a + b\left(R_m - R_f\right) + e, \quad (1)$$

where $R_i - R_f$ represents the portfolio *i* excess returns, *a* represents the intercept term, *b* is denoted as beta, which quantifies how sensitive the excess portfolio return is to changes in the excess market return, $R_m - R_f$ is the excess returns on market *m,* and *e* represents (residual) error terms.

In the context of the Fama-French Model, market capitalization was utilized as a variable for company size, recorded as of June 30th each year from 2012 to 2021. Additionally, P/B ratios were collected as of June 30th each year and subsequently reversed to create B/P data, which was used as a variable for company value. The ratio of net income to book equity as of June 30th each year served as the variable for the profitability factor. For investment, the change in total assets divided by total assets on June 30th was used. The entire dataset was obtained from CMIE PROWESS, a source of financial information on Indian companies.

Eighteen portfolios were constructed using three sorting combinations: size-value, size-profitability, and size-investment.

To quantify the impact of size and value, a portfolio based on a company's size and value was built – market capitalization is the measure of size, and the book-to-price ratio is the measure of value – to capture the size and value effect. Each year, beginning in July 2012 (t), this study divides the whole sample into two categories: small (S) and big (B). The data were initially sorted based on size (MC), with 32 businesses categorized as small (S) in the bottom 50% and 32 businesses classified as big (B) in the top 50%. The sample firms were then divided into three categories – low (L), medium (M), and high

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(H) – based on company valuation (BE/ME) as of June 30, period t. The poorest 30% of companies (19 companies) are classed as low (L) firms, the middle 40% (26 companies) as medium (M) firms, and the top 30% (19 companies) as high (H) firms. After that, this study combines two size (MC) and three value (BE/ME) categories to form six portfolios: B/H, B/M, B/L, S/H, S/M, and S/L. The B/H portfolio showed companies in the big size and high value categories, while the S/L portfolio showed stocks in the small size and low value categories.

In 2012, there were 10 B/H companies, 9 B/M companies, 13 B/L companies, 9 S/H companies, 10 S/M companies, and 13 S/L firms. From July 2012 (t) to June 2013 (t+1), the monthly equally weighted excess returns on these six portfolios were calculated. The portfolios were then reformed in June of year t+1, and the entire process of creating the portfolios and generating returns was repeated until June 2021. Every year, it was observed that the totals in each category varied.

Adhering to the identical methodology, a portfolio based on the size and profitability of the company was built – market capitalization (MC) is the measure of size, and the ratio of net income to book equity (NI/BE) is the measure of profitability. Each year, beginning in July 2012 (t), the entire sample was divided into two groups: small (S) and big (B). The data were initially sorted based on size (MC), with 32 businesses classified in the bottom 50% as small (S) companies and 32 businesses in the top 50% as big (B) firms. Subsequently, the sample firms were categorized into three groups – Robust (R), Neutral (N), and Weak (W) – based on profitability (NI/BE) as of June 30, period *t*. The highest 30% of companies (19 companies) are classed as Robust (R) firms, the middle 40% (26 companies) as Neutral (N) firms, and the lowest 30% (19 companies) as Weak (W) firms. Six portfolios were once more produced by combining two size (MC) and three profitability (NI/BE) categories (B/N, B/R, B/W, S/N, S/R, S/W), with the B/R portfolio indicating stocks in the big size and robust categories and the S/W portfolio indicating stocks in the small size and weak categories. In 2012, there were 12 B/N companies, 10 B/R companies, 10 B/W companies, 14 S/N companies, 9 S/R companies, and 9 S/W firms. From July 2012 to June 2021, in June of every year, six portfolios were reformed, with their equally weighted excess returns recorded. Performance varied across categories on a yearly basis.

Using the same process, a portfolio was constructed based on company size and investment, where market capitalization (MC) served as the measure of size, and the annual growth of total assets represented investment (INV). Each year, beginning in July 2012 (*t*), the sample organizations were divided into two groups: small (S) and big (B). Initially, the data was sorted based on size (MC), with 32 businesses classified in the bottom 50% as small (S) companies and 32 businesses in the top 50% as big (B) firms. The sample firms were then categorized into three groups – Conservative (C), Neutral (N), and Aggressive (A) – based on investment (INV) as of June 30, period *t*. The poorest 30% of companies (19 companies) are classed as Conservative (C) firms, the middle 40% (26 companies) as Neutral (N) firms, and the top 30% (19 companies) as Aggressive (A) firms. Six portfolios were produced by combining two size (MC) and three investment (INV) categories (B/A, B/C, B/N, S/A, S/C, S/N), with the B/C portfolio indicating stocks in the big size and Conservative categories and the S/A portfolio indicating stocks in the small size and Aggressive categories. In 2012, there were 6 B/A companies, 11 B/C companies, 15 B/N companies, 13 S/A companies, 8 S/C companies, and 11 S/N firms. Six portfolios were reformed yearly in June from July 2012 to June 2021; their equally weighted excess returns were recorded every year. Annually, performance varied across categories. Lastly, an estimate of the monthly mean excess returns on portfolios is produced.

Five explanatory variables are employed by Fama and French (2015) to elucidate the cross-section of stock returns.

The excess market return factor is calculated by subtracting the risk-free return (Rm) from the market index returns. The NSE Nifty index is used to assess this.

The size-related risk factor (Small minus Big) (SMB). The average of the three SMALL-size portfolios is subtracted from the average of the three BIG-size portfolios to create the risk factor. It mimics the SMB factor's monthly returns.

$$SMB_{B/M} = 1/3\left(S/H + S/M + S/L\right) - 1/3\left(B/H + B/M + B/L\right). \quad (2)$$

$$SMB_{NI/BE} = 1/3\left(S/R + S/N + S/W\right) - 1/3\left(B/R + B/N + B/W\right). \quad (3)$$

$$SMB_{INV} = 1/3\left(S/C + S/N + S/A\right) - 1/3\left(B/C + B/N + B/A\right). \quad (4)$$

According to Fama and French (FF,2015), the five-factor SMB model is built as follows:

$$SMB = \frac{SMB_{B/M} + SMB_{NI/BE} + SMB_{INV}}{3}. \quad (5)$$

The value-related risk ratio, or High minus Low (HML). The difference between the basic averages of the returns on the two high BE/ME and two low BE/ME is calculated each month. It replicates the HML factor's monthly returns.

$$HML = 1/2\left(S/H + B/H\right) - 1/2\left(S/L + B/L\right). \quad (6)$$

The corresponding coefficients for the independent variables are then obtained by regressing the excess returns on an equally weighted cross-sectional portfolio using (R_m-R_f), (SMB), and (HML) as independent variables and R_i-R_f as the dependent variable in the Fama-French three-factor model (1993).

$$R_i - R_f = a + b_1\left(R_m - R_f\right) + b_2\left(SMB\right) + b_3\left(HML\right) + e, \quad (7)$$

where *SMB* and *HML* are factors for size and value.

Robust minus Weak (RMW) is the return risk factor associated with profitability. The monthly calculation of the disparity between the basic averages of the returns on the two ROBUST stocks and the two WEAK stock portfolios is performed. It replicates the monthly returns of the RMW factor.

$$RMW = 1/2\left(S/R + B/R\right) - 1/2\left(S/W + B/W\right). \quad (8)$$

Conservative minus Aggressive (CMA) is the risk factor in relation to investment. The monthly calculation of the disparity between the basic averages of the returns on the two CONSERVATIVE equities and the two AGGRESSIVE stock portfolios is performed. It replicates the monthly returns of the CMA factor.

$$SMA = 1/2\left(S/C + B/C\right) - 1/2\left(S/A + B/A\right). \quad (9)$$

The corresponding coefficients for the independent variables are then obtained by regressing the excess returns on an equally weighted cross-sectional portfolio using (FF, 2015) with Ri-Rf as the dependent variable and (R_m-R_f), (SMB), (HML), (RMW), and (CMA) as independent variables.

$$R_i - R_f = a + b_1\left(R_m - R_f\right) + b_2\left(SMB\right) + b_3\left(HML\right) + b_4\left(RMW\right) + b_5\left(CMA\right) + e, \quad (10)$$

where *SMB*, *HML*, *RMW,* and *CMA* are factors of size, value, profitability, and investment.

3. RESULTS AND DISCUSSION

Now, this study analyzes the results of our process of classifying securities into double-sorted portfolios and the ensuing regressions using equations 1 (CAPM), 2 (FF three-factor model), and 3 (FF five-factor model).

Table 1, Panel A, presents descriptive data for the average excess returns of portfolios categorized based on their market capitalization (MC) and book-to-price (BE/ME) valuation. The superior performance of the S/H portfolio (2.24%) compared to the B/L portfolio (0.59%) clearly demonstrates significant size impact and value impact. The annualized difference is substantial, around 22%. Table 1, Panel B, displays descriptive statistics for the average excess returns of portfolios with portfolios categorized according to their market capitalization (MC) and net income to book equity (NI/BE) valuation. The S/R portfolio's superior performance (1.80%) in comparison to the B/W portfolio (0.83%) is a clear indication of the substantial size and profitability impacts. The annualized disparity is

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Table 1. Average excess returns

Panel A: MC–BE/ME portfolio						
Portfolio	**Excess S/H**	**Excess S/M**	**Excess S/L**	**Excess B/H**	**Excess B/M**	**Excess B/L**
Average Excess Return	0.022481	0.017871	0.018552	0.004528	0.009326	0.005948
Panel B: MC–NI/BE portfolio						
Portfolio	**Excess S/R**	**Excess S/N**	**Excess S/W**	**Excess B/R**	**Excess B/N**	**Excess B/W**
Average Excess Return	0.018023	0.0193	0.020758	0.006625	0.00673	0.008347
Panel C: MC–INV portfolio						
Portfolio	**Excess S/C**	**Excess S/N**	**Excess S/A**	**Excess B/C**	**Excess B/N**	**Excess B/A**
Average Excess Return	0.019179	0.017017	0.023013	0.007529	0.006576	0.006914

Note: This table shows average Excess Returns based on Portfolios classified by MC – BE/ME, MC – NI/BE, and MC – INV.

considerable, 12%. Table 1, Panel C, provides a descriptive representation of the average excess returns of the portfolios with the data categorized by their market capitalization (MC) and Investment (INV) valuations. The S/C portfolio's superior performance (1.91%) in comparison to the B/A portfolio (0.69%) is a clear indication of the substantial size and investment impacts this portfolio has. The annualized difference is considerable, 16%.

Table 2 displays the risk-adjusted unusual returns from sample portfolios that use the CAPM as an asset pricing standard. To best estimate the CAPM, we consider the excess return version of the market factor model, with alpha values near zero. The outcomes are mixed. At 5%, the alpha is significant for the whole return cross-section, which shows that CAPM does not fully explain returns. However, the results confirm the negligible alpha values of the large portfolios of panel A

Table 2. CAPM results

Overall CAPM					
Portfolio	**a**	**b**	**t(a)**	**t(b)**	**R^2**
Excess Complete Cross-section	0.007598	0.96117	5.000502	30.8474	0.89977
Panel A: MC–BE/ME portfolio					
Portfolio	**a**	**b**	**t(a)**	**t(b)**	**R^2**
Excess S/H	0.015552	1.15732	3.785951	13.738	0.640354
Excess S/M	0.012333	0.92510	4.341114	15.8788	0.704024
Excess S/L	0.013962	0.76669	4.9421	13.2338	0.622955
Excess B/H	–0.00244	1.16350	–0.84747	19.7184	0.785779
Excess B/M	0.003193	1.02417	1.997995	31.2460	0.902062
Excess B/L	0.001717	0.70671	0.678715	13.6258	0.636566
Panel B: MC–NI/BE portfolio					
Portfolio	**a**	**b**	**t(a)**	**t(b)**	**R^2**
Excess S/R	0.01434	0.61517	4.453713	9.31653	0.450201
Excess S/N	0.013317	0.99929	4.435174	16.2286	0.713023
Excess S/W	0.014223	1.09146	3.895770	14.5775	0.667192
Excess B/R	0.002835	0.63303	1.372737	14.9482	0.678249
Excess B/N	–0.00014	1.14663	–0.07038	28.9838	0.887956
Excess B/W	0.001067	1.21582	0.389054	21.6085	0.814986
Panel C: MC–INV portfolio					
Portfolio	**a**	**b**	**t(a)**	**t(b)**	**R^2**
Excess S/C	0.012848	1.05742	3.639157	14.6050	0.668029
Excess S/N	0.011637	0.89854	4.028247	15.1669	0.684556
Excess S/A	0.017580	0.90734	5.397505	13.5840	0.635142
Excess B/C	0.002024	0.91947	0.852255	18.8791	0.770771
Excess B/N	0.000993	0.93241	0.546708	25.0234	0.855225
Excess B/A	0.000827	1.01661	0.287754	17.2442	0.737209

Note: This table shows CAPM results based on portfolios classified by MC – BE/ME, MC – NI/BE, and MC – INV.

Table 3. FF3FM results

Overall FF3FM									
Portfolio	**a**	**b1**	**b2**	**b3**	**t(a)**	**t(b1)**	**t(b2)**	**t(b3)**	**R^2**
Excess Complete Cross-section	0.00131	0.96638	0.49212	0.03158	1.13126	40.8153	11.2531	1.20659	0.95655
Panel A: MC–BE/ME									
Portfolio	**a**	**b1**	**b2**	**b3**	**t(a)**	**t(b1)**	**t(b2)**	**t(b3)**	**R^2**
Excess S/H	0.00134	0.97824	1.15827	0.52593	0.55683	19.9721	12.803	9.71232	0.90871
Excess S/M	0.0006	0.95206	0.95677	0.02168	0.02842	22.2115	12.0849	0.45745	0.87971
Excess S/L	0.00215	0.97376	0.87777	–0.4104	1.15843	25.6809	12.5332	–9.7910	0.87873
Excess B/H	0.00037	0.89911	–0.1573	0.60997	0.18053	21.7431	–2.0589	13.3427	0.92101
Excess B/M	0.00269	1.05233	0.03264	–0.0635	1.47071	28.1404	0.47262	–1.5370	0.90428
Excess B/L	–0.0004	0.90359	0.12325	–0.4537	–0.2073	20.3907	1.50578	–9.2600	0.8008
Panel B: MC–NI/BE									
Portfolio	**a**	**b1**	**b2**	**b3**	**t(a)**	**t(b1)**	**t(b2)**	**t(b3)**	**R^2**
Excess S/R	0.00309	0.77888	0.84417	–0.3111	1.08667	13.418	7.87358	–4.8479	0.68097
Excess S/N	0.00020	1.01943	1.04016	0.04522	0.00098	23.8199	13.1586	0.95579	0.89591
Excess S/W	0.00133	1.00596	1.03180	0.29379	0.48030	17.7197	9.83995	4.68093	0.85634
Excess B/R	0.00115	0.77477	0.09885	–0.3257	0.59406	19.6568	1.35783	–7.4746	0.79073
Excess B/N	0.00050	1.15181	–0.0076	–0.0129	–0.0244	25.2381	–0.0902	–0.2558	0.88805
Excess B/W	0.00319	1.00725	–0.1173	0.48179	1.33457	20.6034	–1.2995	8.91418	0.89513
Panel C: MC–INV									
Portfolio	**a**	**b1**	**b2**	**b3**	**t(a)**	**t(b1)**	**t(b2)**	**t(b3)**	**R^2**
Excess S/C	0.00070	0.99451	0.96864	0.23484	0.24115	16.8786	8.90052	3.60506	0.83492
Excess S/N	–0.0006	0.95593	0.94485	–0.0512	–0.2541	20.6352	11.0426	–0.9997	0.85518
Excess S/A	0.00361	0.96755	1.08214	–0.0456	1.44184	18.9216	11.4576	–0.8067	0.83945
Excess B/C	0.00312	0.84951	–0.0693	0.15895	1.17122	15.6186	–0.6895	2.64336	0.78534
Excess B/N	0.00127	0.93518	–0.0227	–0.0086	0.60542	21.7613	–0.2854	–0.1801	0.85541
Excess B/A	0.00041	1.05279	0.02395	–0.0832	0.1246	15.5658	0.19174	–1.1133	0.7403

Note: This table shows FF3FM results based on portfolios classified by MC – BE/ME, MC – NI/BE, and MC – INV.

(B/H, B/M, and B/L), panel B (B/R, B/N, and B/W), and panel C (B/C, B/N, and B/A), but the alpha values of all small portfolios in panel A (S/H, S/M, and S/L), panel B (S/R, S/N, and S/W), and panel C (S/C, S/N, and S/A) are statistically significant, indicating that the CAPM has failed to capture their projected return based only on beta. Thus, it remains uncertain whether the CAPM holds true in the Indian market. The overall model demonstrates an explanatory power of 89.98%, as indicated by the R^2 value.

Table 3 records the regression results of the Fama-French three-factor model. FF3FM significantly improves the explanatory power of stock returns compared to the Capital Asset Pricing Model (CAPM). By incorporating SMB (size factor) and HML (value factor), FF3FM addresses key weaknesses of CAPM, particularly in explaining small-cap and value stock returns. The overall R^2 for FF3FM is 95.65%, much higher than CAPM's R^2 of 89.98%, indicating that adding the size and value factors enhances the model's ability to explain stock return variations. Additionally, the intercept, which was significant in CAPM (t-value = 5.00), becomes insignificant in FF3FM (t-value = 1.13). This suggests that the additional risk factors in FF3FM better capture the sources of return, reducing unexplained alpha. Examining the SMB (size) factor, it is highly significant for small-cap portfolios (S/H, S/M, S/L), where t-values exceed 2, confirming that small stocks tend to generate higher returns than large stocks. However, the SMB factor is not significant for large-cap portfolios (B/H, B/M, B/L), showing that size has little impact on big companies. This suggests that the size effect is an important driver of excess returns in small-cap stocks in India, a factor that CAPM fails to capture. Similarly, the HML (value) factor) is strongly significant for high book-to-market (value) stocks like S/H and B/H, confirming that value stocks tend to outperform growth stocks in the Indian market. Conversely, HML is negative and significant for low book-to-market (growth) stocks like S/L and B/L, implying that growth stocks exhibit lower expected returns. This con-

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Table 4. FF5FM results

Overall FF5FM													
Portfolio	**a**	**b1**	**b2**	**b3**	**b4**	**b5**	**t(a)**	**t(b1)**	**t(b2)**	**t(b3)**	**t(b4)**	**t(b5)**	**R^2**
Excess Complete Cross-section	0.001	0.951	0.495	−0.02	−0.07	0.015	1.13	36.19	11.35	−0.6	−1.59	0.457	0.958
Panel A: MC–BE/ME													
Portfolio	**a**	**b1**	**b2**	**b3**	**b4**	**b5**	**t(a)**	**t(b1)**	**t(b2)**	**t(b3)**	**t(b4)**	**t(b5)**	**R^2**
Excess S/H	0.001	0.976	1.162	0.501	−0.02	0.035	0.553	17.72	12.71	5.792	−0.23	0.492	0.909
Excess S/M	0.001	0.905	0.957	−0.10	−0.19	−0.026	0.014	19.23	12.25	−1.478	−2.348	−0.429	0.886
Excess S/L	0.002	0.965	0.878	−0.43	−0.03	0.001	1.146	22.62	12.4	−6.522	−0.495	0.017	0.879
Excess B/H	0.001	0.88	−0.145	0.498	−0.123	0.099	0.181	19.49	−1.939	7.022	−1.539	1.699	0.926
Excess B/M	0.003	1.048	0.023	−0.02	0.018	−0.09	1.478	25.3	0.328	−0.403	0.241	−1.789	0.908
Excess B/L	−0.00	0.891	0.138	−0.56	−0.10	0.133	−0.214	18.5	1.733	−7.466	−1.267	2.141	0.815
Panel B: MC–NI/BE													
Portfolio	**a**	**b1**	**b2**	**b3**	**b4**	**b5**	**t(a)**	**t(b1)**	**t(b2)**	**t(b3)**	**t(b4)**	**t(b5)**	**R^2**
Excess S/R	0.003	0.912	0.837	0.09	0.573	0.013	1.277	16.09	8.904	1.01	5.729	0.18	0.761
Excess S/N	−0.00	0.982	1.022	0.033	−0.088	−0.19	−0.015	21.39	13.4	0.451	−1.091	−3.219	0.906
Excess S/W	0.001	0.896	1.065	−0.17	−0.568	0.238	0.593	18.27	13.07	−2.204	−6.566	3.772	0.916
Excess B/R	0.001	0.864	0.117	−0.169	0.303	0.218	0.713	22.26	1.817	−2.767	4.427	4.355	0.84
Excess B/N	−0.001	1.137	−0.02	0.008	−0.015	−0.123	−0.031	22.51	−0.239	0.105	−0.173	−1.89	0.892
Excess B/W	0.003	0.879	−0.11	0.091	−0.556	−0.008	1.578	19.55	−1.477	1.29	−7.013	−0.131	0.93
Panel C: MC–INV													
Portfolio	**a**	**b1**	**b2**	**b3**	**b4**	**b5**	**t(a)**	**t(b1)**	**t(b2)**	**t(b3)**	**t(b4)**	**t(b5)**	**R^2**
Excess S/C	0.001	1.01	1.018	0.037	−0.109	0.463	0.306	18.63	11.31	0.43	−1.144	6.632	0.89
Excess S/N	−0.001	0.905	0.95	−0.216	−0.227	0.017	−0.275	17.94	11.34	−2.724	−2.546	0.266	0.865
Excess S/A	0.004	0.931	1.04	0.058	−0.004	−0.409	1.701	19.46	13.1	0.777	−0.049	−6.646	0.89
Excess B/C	0.003	0.866	−0.019	−0.043	−0.11	0.474	1.526	18.39	−0.239	−0.581	−1.329	7.825	0.873
Excess B/N	0.001	0.973	−0.014	0.056	0.129	0.099	0.625	20.5	−0.181	0.757	1.534	1.613	0.861
Excess B/A	0.001	0.946	−0.041	−0.065	−0.216	−0.654	0.125	16.51	−0.426	−0.719	−2.134	−8.869	0.853

Note: This table shows FF5FM results based on portfolios classified by MC – BE/ME, MC – NI/BE, and MC – INV.

firms that the value premium exists in India, a relationship that CAPM does not account for.

Table 4 displays the regression outcomes derived from the Fama-French Five-Factor Model. With the inclusion of the profitability (RMW) and investment (CMA) factors, the FF5FM aims to improve the explanatory power of stock returns compared to the FF3FM and CAPM. A key metric for comparison is the R^2 value, which indicates how well the model explains stock return variations. The overall R^2 for FF5FM is 95.78%, slightly higher than FF3FM (95.65%) and significantly higher than CAPM (89.98%). Additionally, the intercept, which was significant in CAPM (t = 5.00), remains insignificant in both FF3FM (t = 1.13) and FF5FM (t = 1.12). This suggests that adding the RMW and CMA factors does not drastically improve model performance over FF3FM. While FF5FM provides the best overall fit, the improvement over FF3FM is marginal, raising questions about the relevance of profitability and investment factors in the Indian market. Examining the profitability factor (RMW), we find that most RMW coefficients are statistically insignificant. For instance, S/H (b4 = −0.0223, t = −0.23), S/L (b4 = −0.0372, t = −0.49), and B/H (b4 = −0.1225, t = −1.54) show weak or negative effects. The only exception is S/M (b4 = −0.1948, t = −2.34), which is significant but negative, suggesting that higher profitability does not lead to higher expected returns in India, unlike in global markets. This weak relationship indicates that profitability is not a strong determinant of stock returns in India, making the RMW factor less relevant. Similarly, the investment factor (CMA) appears mostly insignificant. For example, S/H (b5 = 0.0348, t = 0.49), S/M (b5 = -0.0259, t = −0.43), and B/H (b5 = 0.0987, t = 1.69) all show weak effects, while B/L (b5 = 0.1327, t = 2.14) is the only statistically significant portfolio. This suggests that investment strategies (high vs. low investment firms) do not strongly influence stock returns in India, unlike in developed markets, where high-investment firms typically yield lower

returns. The weak CMA coefficients indicate that investment intensity is not a major risk factor in India, reinforcing the idea that the FF5FM does not offer significant improvements over FF3FM.

The findings reveal that the traditional CAPM fails to fully explain stock returns in the Indian market, as indicated by significant alphas for small-cap portfolios. The Fama-French three-factor model (FF3FM) substantially improves explanatory power by incorporating the size (SMB) and value (HML) factors, confirming that small and value firms earn higher excess returns than large and growth firms. This supports the strong presence of size and value effects in India. However, the five-factor model (FF5FM) offers only marginal improvement over the FF3FM. The added profitability (RMW) and investment (CMA) factors are mostly insignificant, suggesting that these global risk factors have limited relevance in the Indian context. Overall, while multifactor models outperform the CAPM, the FF3FM remains the most effective model for explaining cross-sectional variations in stock returns in India, highlighting the dominance of size and value effects and the weak role of profitability and investment factors.

The empirical results support H1, confirming that the Fama-French Three-Factor Model (FF3FM) provides a better explanation of stock returns in the Indian market than the CAPM. The explanatory power improves significantly, with R^2 rising from 89.98% under CAPM to 95.65% under FF3FM, and the inclusion of size (SMB) and value (HML) factors eliminates the significant alpha observed in CAPM. H2 is partially accepted, as the Fama-French Five-Factor Model (FF5FM) shows a marginal increase in explanatory power (R^2 = 95.78%) compared to FF3FM, but the improvement is statistically minor, indicating limited contribution from the additional profitability (RMW) and investment (CMA) factors. H3 is accepted, since both RMW and CMA coefficients are largely insignificant, suggesting that these factors do not meaningfully enhance the explanatory power of asset pricing models in the Indian context. Finally, H4 is accepted, as the SMB factor remains strong and significant, confirming that small-cap stocks earn higher excess returns than large-cap stocks and that the size effect is a dominant driver of stock returns in India.

CONCLUSION

This article analyzes whether average returns on portfolios based on market capitalization, price-to-book ratio, profitability, and investment display any trends. The ability of asset pricing models, including the Capital Asset Pricing Model (CAPM), the Fama-French three-factor model, and the Fama-French five-factor model, to accurately explain the average returns of portfolios constructed based on size, value, profitability, and investment is assessed. The asset pricing findings demonstrate that the Fama-French Three-Factor Model (FF3FM) consistently outperforms CAPM across all aspects. Its higher R^2, lower and insignificant intercepts, and the strong significance of the SMB (size) and HML (value) factors confirm that CAPM alone is inadequate in explaining stock returns in the Indian market. The dominance of size and value effects indicates that investors cannot rely solely on market risk (RM-RF) but must consider these additional factors when evaluating asset returns.

Additionally, the findings suggest that across all three comparisons, small-cap stocks outperform large-cap stocks in India when sorted by value (B/M), profitability (RMW), and investment (CMA). The strongest performance gap is between S/H and B/L, confirming that value investing is a dominant strategy in India, with small value stocks significantly outperforming large growth stocks. While profitability and investment factors are less influential, they still indicate that small profitable firms (S/R) slightly outperform large weak-profitability firms (B/W), and small conservative firms (S/C) generate higher returns than large aggressive investment firms (B/A).

This study has certain limitations, primarily due to its scope and model selection. The study is confined to a comparative analysis of the CAPM, FF3FM, and FF5FM models, without considering alternative asset pricing models that may enhance explanatory power. Notably, the momentum factor, introduced

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by Carhart (1997), which has been identified as a significant anomaly in the Capital Asset Pricing Model (CAPM), is not included in this research. Since momentum has been observed as a persistent driver of stock returns, its exclusion may limit the robustness of our findings.

Additionally, the study does not incorporate other business fundamentals, such as working capital, human capital, or firm-specific operational efficiency metrics, which could further explain return variations beyond the size, value, profitability, and investment factors used in the Fama-French models. These factors may be particularly relevant in emerging markets like India, where market inefficiencies and firm-specific attributes play a more significant role in asset pricing.

Furthermore, the study is limited in terms of data scope, as it focuses solely on the Nifty 100 index, which comprises large and mid-cap stocks. This may not fully capture the effects of the Fama-French factors across small-cap stocks or other market segments. The research period, spanning nine years from 2012 to 2021, may also influence the findings, as factor performances can vary across different economic cycles or market conditions. A longer research period or cross-market comparison could enhance the generalizability of the results.

AUTHOR CONTRIBUTIONS

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