

Evaluating the Fama-French Three and Five Factor Models in the Indian Equity Market

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Abstract

Purpose: The aim of this research work is to evaluate the applicability and explanatory performance of three and five factor model by Fama & French on the Indian stock market returns. The analysis tests the contribution of the operating profitability (OP) and investment to increase the explanatory power of the classic three-factor model and explores pricing anomalies.

Design/Methodology/Approach: A quantitative research methodology is used in this study with secondary data from non-financial Companies (Cos.) registered on the (NSE) and (BSE), India. The Fama–French 2×3 sorting approach with firm size and book-to-market (B/M) characteristics was used to build the portfolios in the FF3FM, and in FF5FM 2×3, 2×3, 2×3 for each factor added profitability and investment factors. Factor sensitivities were estimated using time-series regression analysis and overall asset pricing model efficiency was evaluated using the Gibbons-Ross-Shanken (GRS) test.

Results: The empirical findings suggest that all of the risk factors presented in both the FF3FM and FF5FM model do not significantly account for these portfolio excess returns over the study period. The explanatory power of both models is low which is seen with negative adjusted R^2 values for all estimated portfolios. Moreover, the result of GRS test rejects the joint hypothesis of both models having intercepts of zero which implies that both models have abnormal returns that could not be explained and neither model is mean variance efficient in the Indian equity market. The traditional three-factor model has little increment in performance when OP (RMW) and investment (CMA) factors are added.

Originality/Value: This study builds on the scarce empirical research on the usefulness of the Three & Five Factor Model in an emerging market and compares the two models, the FF3FM and the FF5FM, using stock market data of India. The results imply that there is some additional market-specific risk factor missing from the literature that needs to be considered to be able to explain cross-sectional stock returns, which has implications for researchers, investors and policy makers interested in asset pricing in emerging markets.

Keywords: FF3F; FF5FM; Asset Pricing; Indian Stock Market; Portfolio Returns; Gibbons-Ross-Shanken Test; Emerging Markets.

1. Introduction

Financial markets enhance economic growth, capital accumulation, and allocation. For more than 50 years, financial economics has been interested in the asset valuation and the determinants of asset returns. It is vital for investors, portfolio managers, financial institutions and politicians to have appropriate models to explain risk and return to enhance investment decisions and portfolio performance. Therefore, asset pricing models are one of the most important fields of finance study nowadays. The (CAPM) is one of the earliest and most well-known theoretical models that was developed to predict stock returns and was independently established by (Sharpe, 1991). Under CAPM, investors are only rewarded for the systematic market risk (beta). The model predicts that the greater the systematic risk of assets the greater their return, and that unsystematic risk is eliminated due to diversification. CAPM's simplicity and theoretical elegance have led to the use of CAPM in portfolio management, performance measurement, capital budgeting, and corporate finance. Although widely accepted, empirical research over the past few decades has confirmed that cross-sectional variance in stock returns is not fully accounted for by market beta. Empirical anomalies challenge the assumptions and prediction power of CAPM and thus lead to more complete multifactor asset pricing models. There is an interesting size effect discovered, which reveals that companies with small market capitalization have, on average, performed better than CAPM expected. The value anomaly was discovered by (Rosenberg, 1981) who determined that high B/M equity ratio COs. outperformed low ratio COs.. Other researchers, such as (Chen, no date) (1991), and others have shown that portfolios' returns are not predicted by the market β alone but are driven by other firm-specific factors, such as earnings yield, valuation ratios, and financial fundamentals. These data showed that the single-factor model was not suitable for the complexity of the mechanisms by which returns are generated in financial markets. FF3FM (1992) demonstrated that the cross-sectional variation in average portfolios returns in the U.S. could be predicted more accurately by business size and B/M equity ratio than market beta, although given these empirical restrictions. Given the above results, (Fama and French, 1992) introduced the FF3FM, which incorporates two additional systematic risk factors to CAPM, size (SMB), and value (HML). These features significantly improved the model's ability to predict portfolio performance and to develop the field of empirical asset pricing. The FF3FM is one of the most widely used and tested multifactor asset pricing models in well-developed and developing financial markets that have been in use for three decades.

The Three-Factor Model added significantly in the improvement of CAPM, but empirical evidence found that some return anomalies could not be explained. Businesses with sustained high operational profitability achieved higher average returns than businesses with substandard profitability, while conservative investment policies outperformed aggressive investment policies. The results revealed that profitability and investment decisions could be the dimensions of systematic risk that are not addressed in the three factor model. These developments led (Novy-Marx, 2014) to demonstrate that profitability influences expected stock returns, justifying further development of the classic asset pricing models. Given this information, (Fama and

French, 2016)) came up with the FF5FM model that added market, size and value with OP and investment factor. The updated model explained the returns of the stocks better and abated the abnormal returns.

The FF5FM has been studied by many scholars and is widely discussed in the financial markets since its first introduction. There has been some evidence of increased explanatory power in numerous empirical studies since the Three-Factor Model. National, industry and market conditions have different effects on profitability and investment performance elements. In some well-developed markets the explanatory power of this model is considerably enhanced, whereas in many developing countries the significance of the model is weak or even non-existent.

There is a need for multiple factors asset pricing models in emerging economies, where capital markets are very different from those in established economies. Emerging markets are characterized by more information asymmetry, less liquidity, more volatility, evolving regulation, and a different investor involvement. These are exceptional characteristics that impact systematic risk pricing and could alter the traditional asset pricing models' explanations of stock returns. Therefore, it's essential to test results from developed economies in emerging economies. It has resulted in increased attention by scholars to multi-factor asset pricing models in emerging markets. The Indian economy is considered as one of the biggest rising economies and the Indian equity market is fast-growing. Thousands of COs. are listed on the NSE and BSE, in a wide variety of industries, and they attract local and international investment. The Indian capital market has undergone significant changes in the past 20 years, driven by various factors such as regulatory reforms, technological advancements, enhanced corporate governance, and greater institutional investor involvement, among others. These changes have added to the complexity and market competencies in the Indian equity market's return-generating process. So it is both academic and applied to consider asset pricing models in the context of current market circumstances.

With growing body of literature on multifactor assets pricing models, there is still an absence of clarity on the relative performance of the FF3FM and FF5FM in India. Market and size variables have been found to affect stocks' returns by several studies, and profitability, and investment factors have had mixed results. Some studies show that the FF5FM accounts for an extensive amount of explanatory power; others that no additional explanatory power can be gained from the five factor than from the three factor formulation. These discrepancies could arise from sample periods, from how portfolios are created, from how businesses are selected, from econometric methods, from the regimes in the market, and from the sectoral mix. In India there is no consensus regarding which model is better.

The other major gap in the literature is the lack of evaluation of the model performance. Many empirical studies compare asset pricing models by looking at the regression coefficients, adjusted coefficients of determination or significance of the factors. These measurements provide valuable information but may not be a good indicator of the efficiency of a factor model in predicting portfolio returns. Gibbons-Ross-Shanken (GRS) tests whether regression intercepts are statistically indistinguishable from zero across all test portfolios for a more stringent framework. This method lets researchers assess whether an asset pricing model incorporates systemic anticipated returns rather than just increasing statistical fit. The GRS paradigm has not been frequently employed in Indian equities market studies enabling a more comprehensive

comparison analysis. This methodological gap is addressed in your paper with the use of GRS and time-series regressions. The present study compares the FF5FM and FF3FM using the companies registered on the NSE and the BSE. Based on the portfolio creation method developed by Fama and French, enterprises are sorted into characteristic-based portfolios and established risk factors according to the market capitalization, B/M equity ratio, OP, and investment characteristics. Time-series regression analysis assesses the variables that explain the asset price, while the GRS test assesses mistakes in asset pricing in the portfolios. This thorough empirical approach critically examines the influence of profitability and investment factors on portfolios returns in Indian equities market. Your thesis is an empirical design incorporating characteristic-based portfolios, monthly data, time-series regressions and GRS testing. The present research offers many noteworthy literary contributions. First, it provides an update on the performance of the FF3FM and FF5FM performance in one of the world's most volatile developing equities markets. Second, it investigates the effects of profitability and investment characteristics on performance beyond the scope of market, size and value in India. Third, there is also a full model efficiency evaluation, including regression diagnostics, using the framework of characteristic-based portfolio design, time-series regression analysis, and the GRS testing framework. The results will be useful for the general literature on multifactor asset pricing and can be applied to investors, portfolio managers, financial analysts, and policy makers from around the world who are interested in the issue of returns on new financial market stocks.

2. Literature Review

In the last 50 years asset pricing theory has undergone a significant transformation to tackle a number of empirical oddities that have always plagued conventional financial theories. The goal of any assets pricing model is to understand the variation in expected portfolio returns across stocks and find systematic risk factors that investors are compensated for holding. While the (CAPM) provided the theoretical basis for the modern approach to portfolio management, later empirical evidence showed that the differences in firm stock returns cannot be fully explained by a firm's market beta. This restriction led to the evolution of multi-factor asset pricing models, including the FF3FM and FF5FM, which have been thoroughly studied in empirical finance.

2.1 Evolution of Asset Pricing Models

According to (Sharpe, 1991) (WEBSTER, 2014) the expected return on a stock is a role of market risk only. It is still the basic model in financial economics, but many empirical papers have reported systematic deviations from the model's predictions. Some preliminary findings by (Basu, 1977) established that those COs. with high earnings-price ratios consistently earned abnormal returns, and (Banz, 1981) established the size anomaly whereby small cap COs. earned greater average than predicted returns using CAPM. In a similar study, (Rosenberg, 1981), and (Lanstein and Jahnke, 1979) conclude that the high B/M equity COs. significantly outperformed the growth COs. beyond the market beta effect.

Based on these anomalies, (Fama and French, 1993) showed that the size and book-to-market equity of individual COs. accounted for the cross-sectional differences in portfolio returns better than beta. They then added three additional factors to their model: market risk (MKT-Rf), (SMB), and (HML), which greatly enhanced the analytical power of CAPM. The Three-Factor Model has been widely adopted since publication and has been the subject of extensive testing in developed and emerging markets since then.

Although popular, this model (FF3FM) was found to be insufficient to account for all return anomalies by later research. (Novy-Marx, 2014) found that highly profitable COs. on an operating basis consistently achieved better returns and that investment anomalies indicated that COs. investing conservatively (as opposed to aggressively) performed better. Taking these results into account, (Fama and French, 2016) expanded size, and value with OP (RMW) and investment (CMA) factors, creating the Five-Factor Model. The new system was designed to give a more complete description of what was expected for the stocks, while minimizing pricing mistakes.

2.2 Empirical evidence for the Three Factor Model by Fama & French.

FF3FM Model has received a large amount of validation in developed markets and has been shown that in to explaining the cross-section of return this model is more capable than CAPM in general. But findings from emerging markets are inconclusive as country conditions are very different in terms of institutional environment, accounting quality, investors' actions and market efficiency.

Empirical studies more recently have suggested that the role of the traditional Fama-French factors remains market-dependent. Studying the FF5FM Model across selected developed and emerging markets, (Mosoeu and Kodongo, no date) (2022) discovered that profitability was the most powerful of all the factors in emerging markets, while the market factor was relatively less powerful than anticipated. Their results also proved that the Five-Factor Model did not pass the Gibbons-Ross-Shanken (GRS) test in certain markets, meaning that significant factors of systematic risk were not explained.

Likewise, (Foye, 2018) noted that the lack of coherence in results from emerging markets is largely due to institutional quality, methods of portfolio construction, accounting standards, and market structure. The review highlighted the need to exercise caution when extrapolating empirical results from one country to another, as local institutional factors can have a strong effect on the pricing of systematic risk factors. It suggests that regional market factors affect asset pricing models. The results show that market-specific factor models are crucial. The study provides international evidence and a good standard for comparing Fama & French factor models in the equity market of India (Foye, 2016).

The studies taken together indicate that while the Three-Factor Model is still a significant standard for empirical finance, its explanatory power is significantly influenced by the market environment and the methodologies used for the formation of portfolios and the construction of factors.

2.3 Development and Performance of the Five Factor Model by Fama & French

FF5FM Model was one of the major advances in empirical asset pricing in the last decade. FF5FM aimed to uncover return patterns that were not addressed by the classic FF3FM, by incorporating *OP* and *investment* factors. The model has then been tested in a number of developed and developing markets with mixed results.

(Tripathi and Singh, 2021) conducted a thorough study on factor models in the equity market of India and studied the performance of the FF5FM in explaining portfolio returns in each industrial industry. They found that the model works well in, say, the industrials, basic materials, and oil sectors, but for consumer-oriented industries more unknown factors were needed. The results indicated that the relevance of the factors varies significantly among industries, thus reflecting an industry-specific effect on the pricing of systematic risk.

The FF5FM has greatly enhanced asset pricing theory by adding the OP (RMW) and investment (CMA) factors to the market β , size and value factors. Several anomalies, such as market beta, share repurchases, stock volatility, and investment behavior, can be explained by these additional factors and provide a better clarification of the original three factors model (Fama and French, 2016). Building on this, (Paliienko, Naumenkova and Mishchenko, 2020) pointed out the practical benefits of the five-factors model for portfolio assessment and suggested adjustments to enhance the model's use in various market scenarios and portfolio sizes. Likewise, (Foye, 2018) reported that the FF5F performs better than the FF3F model in emerging markets of Eastern Europe and Latin America, but the investment factors and profitability factors are not as predictive in Asian markets, suggesting differences in the relevance of factors across Asia and other markets. The FF5F model was successful in explaining patterns of returns across North America, Europe and the Asia Pacific region countries, but not as well in explaining the returns of small, low profitability COs. with aggressive investment strategies.

2.4 Evidence from emerging markets

Evidence from India supported this evidence by comparing the explanatory power of both asset pricing models on BSE listed COs. for a much longer period. The authors found that the FF5FM Model performed best overall when combined with GRS statistics and factor spanning tests, but OP and investment factors had varying impacts on the model as it was defined using different portfolio construction techniques. Another important finding from the study was that the strength

of the empirical conclusions was greatly influenced by the amount of portfolios used and the statistical data evaluation processes utilized.

Emerging financial markets have now grown into an important test case for the application of multifactor asset pricing models given the institutional features of these markets are significantly different than those of developed markets. Systematic risk factor behavior can be changing due to varying information asymmetries, lower liquidity, changing regulatory environments, and heterogeneous participation of investors.

Comparative evidence recently suggests that profitability becomes more important in emerging economies than it was thought. (Mosoeu and Kodongo, no date) (2022) found that OP always was able to capture the average portfolio returns in various emerging markets, whereas the traditional market factor had relatively low explanatory power. However, despite the incorporation of OP and investment factors, the FF5FM Model still had pricing errors as demonstrated by the GRS tests, suggesting that there may be other risk factors needed to fully explain the variance in returns.

In more recent times, (Bongaerts, Kang and Van Dijk, 2026) suggested that intangible assets are an emerging driver of systematic risk in today's financial markets. They built an intangibles factor in their study that added to the explanatory power of traditional multifactor asset pricing models and dampened the explanatory power of the traditional investment factors. The results indicate that asset pricing research is not only moving away from the classic Fama-French model but also in the knowledge-intensive economies.

2.5 Studies on India

In recent years, the incredible growth and transformation of India's capital markets have gained the interest of researchers in the applicability of the Fama & French's asset pricing models in the equity market of India. The initial empirical research was devoted to tests of the (CAPM) but later work moved to multi-risk factor asset pricing models as evidence was provided that cross-sectional stock returns could not be captured by market beta alone. After the emergence of the FF3F Model of Fama & French, a number of Indian studies found that the market factor, size and value have significantly boosted the explanation of stock return over CAPM. The magnitudes and significance of these factors, however, differed over time, across portfolio construction techniques and market segments. As FF5FM (2015) introduced the Five-Factor Model, researchers in India have been increasingly interested in understanding if OP (RMW) and investment (CMA) factors offer any other explanation. For example, (Tripathi, Sapra and Gupta, 2021) have stated that there is a disparity in the performance of the FF5F Model in different industries, which means that profitability and investment factor are not always relevant in the Indian market. In the same way, (Bahl, no date) (2021) has found that the impact of those

additional factors was not consistent across different approaches to portfolio construction and firm attributes, though the FF5FM generally proved to perform better than the simpler asset pricing models.

Not-with-standing these developments, the empirical results from India are yet to be definitive in determining the superiority of the Three-Factor and Five-Factor Models. It has been documented in several papers that the Five-Factor Model adds explanatory power to some portfolios, but by a relatively small and inconsistent amount to the traditional Three-Factor Model. Many of the differences can be explained by the different samples used by the researchers, the methods used to estimate the stock, the methods used to construct the factors, the breakpoints used for market capitalization, and the methodology used by the researchers. Additionally, the importance of evaluating pricing errors over a range of asset pricing models (APMs) using the GRS test has been established over the years, but, only a few studies have applied such a complete approach to model evaluation to Indian data. Therefore, the empirical findings of extended factors on the performance of asset pricing are inconclusive. These issues should be addressed in a future study, that uses a standardized portfolio construction method and a thorough statistical analysis method, that compares the FF3FM with the FF5FM to provide more solid evidence for investors, researchers, and policymakers.

3. Research Gaps

Although a lot of research has been done in well-established country markets, there is no clear idea about the explanatory power of both models (FF3FM and FF5FM) in the Indian stocks market. Previous studies on the extra contribution of OP (RMW) and investment (CMA) arriving with conflicting results due to various reasons including sample length, portfolio construction techniques, estimation approaches, and market conditions. There is no consensus, but the FF5FM Model is better in explaining Indian stock returns than the FF3FM. Research in India has found the GRS test to be useful in determining the joint significance of price errors, and most research has relied on regression-based measures. With more efficient markets, institutional participation and company characteristics evolving in the Indian capital markets, it is high time to revisit the validity of multifactor asset pricing models in the Indian context with the latest data. This study adopts a standard portfolio construction methodology, time-series regression and GRS test to check whether those extra profitability and investment factors enhance the excess portfolio returns in the equity market of India, when compared to FF3FM and FF5FM.

Research Problem

FF3FM and FF5FM are the most popular asset pricing models used in Indian equities market, however, there is no consensus on which model is more appropriate in Indian context. Profitability and investment factors have varied results from past research because of the sample

selection, design of the portfolios, estimation techniques and assessment methods. Therefore, the FF5FM Model's appropriateness over the FF3FM Model in India is unclear. This study aims to relate the capability of the FF3FM Model and the FF5FM Model in explaining the performance of the portfolios created on the standardized basis using time-series regression analysis and the GRS test. The findings are expected to have implications in the equity market of India in terms of the applicability of the multi-factor asset pricing models and for implications in the world of investing and portfolio management. FF3FM and FF5FM are commonly used in asset pricing research, but there is empirical disagreement with respect to which of the two models is more appropriate to describe the stock returns in the Indian equities market. However, the profitability and investment factors have shown mixed picture in previous studies due to the sample selection, nature of the portfolio, estimation procedures and assessment techniques. Thus, its applicability of both the Models in India remains debatable. This study compares the performance of both the models i.e. FF3FM and FF5FM in explaining the standardized portfolio creation, time-series regression and the GRS. The results are expected to assist in determining the applicability of the multi-factor asset pricing models in the stock market of India as well as in the investing and portfolio management decisions.

Research Questions

RQ1: Does the FF5FM Model explain portfolio returns more effectively than the FF3FM Model in the equity market of India?

RQ2: Which of the risk factors- “market, size, value, operating profitability, and investment” significantly influence portfolio returns in India?

RQ3: Do the OP (RMW) and investment (CMA) factors provide significant incremental explanatory power beyond the traditional FF3FM Model?

RQ4: Which model demonstrates superior performance based on time-series regression analysis and the GRS test?

Research Objectives

1. To construct the Fama-French's market β , size, value, OP and investment risk factors using COs. listed on the (NSE) and the (BSE).
2. To estimate the FF5FM and FF3FM using time-series regression analysis.
3. To observe the significance of the market β , size, value, OP, and investment in explaining portfolio excess returns.
4. To compare the explanatory power of the FF5FM and FF5FM Models using regression diagnostics and goodness-of-fit measures..

5. To assess whether the inclusion of OP and investment factors provides significant explanatory power over the traditional FF3FM in the Indian equity market.

4. Hypothesis

H1: *The (MKT-Rf) has a significant positive impact of excess returns on portfolios in the Indian equity market.*

H2: *The (SMB) has a significant impact of excess average returns on portfolios in the equity market of India.*

H3: *The (HML) has a significant impact of excess average returns on portfolios in the equity market of India.*

H4: *The (RMW) has a significant impact of excess average on portfolios in equity market of India.*

H5: *The (CMA) has a significant impact of excess average return on portfolios on the equity market of India.*

H6: *The recent FFFM Model provides significantly greater explanatory power than the traditional FF3FM Model in explaining excess portfolio returns in the Indian equity market.*

5. Research Methodology

5.1 Research Design

The study follows a quantitative and explanatory approach with the intention of comparing the explanatory power of the FF3FM and FF5FM in the Indian equity market. Drawing on secondary data, the study looks at the time-series relationship between systematic risk factors and portfolio excess returns. The GRS test further assesses pricing efficiency of the competing models.

5.2 Data Source and Sample Selection

The study has been carried out on secondary data of registered non-financial companies of the (NSE) and the (BSE). The monthly prices, market capitalization, book equity, OP, total assets and the risk free rate were taken from trusted financial databases. For consistency and reliability of data, COs. with incomplete financial information, negative book equity and/or lack of trading history were excluded.

Tab11: Sample Selection Criteria

Criteria	Description
Population	Non-financial companies listed on NSE and BSE
Sampling Technique	Purposive sampling

Data Frequency	Monthly
Data Type	Secondary data
Exclusion Criteria	Financial COs., COs. with negative book equity, and missing observations

5.3 Portfolio Construction

The Fama–French factors were created according to the method suggested by Fama and French (1993, 2015). A 2×3 portfolio formation approach, based on market capitalization, B/M ratio, OP and investment, was used independently to sort the COs.. Six portfolios were established for each sorting criteria to produce the SMB, HML, RMW and CMA factors. (MKT-Rf) was defined as the difference between the market returns and risk-free rate.

5.4 Variables Used in the Study

The study estimates portfolio excess returns as the dependent variable, whereas the Fama & French risk factors serve as independent variables.

Table2: Description of Variables

Variables	Description	Measurement
Dependent Variable	Portfolio Excess Return	(Rp-Rf)
MKT–Rf	Market Risk Premium	Market Return – Risk-free Rate
SMB	Size Factor	Small Minus Big
HML	Value Factor	High Minus Low
RMW	Profitability Factor	Robust Minus Weak
CMA	Investment Factor	Conservative Minus Aggressive

5.5 Model Specification

The Fama & French Three Factor Model is specified as:

$$R_{it} - R_{ft} = \alpha_i + \beta_i (MKT - RF)_t + \beta_{iSMB} SMB_t + \beta_{iHML} HML_t + \epsilon_{it}$$

The Fama & French Five Factor Model is specified as:

$$R_{it} - R_{ft} = \alpha_i + \beta_i (MKT - RF)_t + \beta_{iSMB} SMB_t + \beta_{iHML} HML_t + \beta_{iRMW} RMW_t + \beta_{iCMA} CMA_t + \epsilon_{it}$$

5.6 Data Analysis Techniques

This study uses Ordinary Least Squares (OLS) time-series regression to estimate the parameters of the FF3 and FF5 models. Performance of the models is calculated with regression co-efficient, t-statistics, p-value, adjusted R^2 and F-statistics. Overall pricing efficiency of both models is checked by the GRS test, which tests whether the intercepts are jointly equal to zero. Moreover,

the diagnostic tests of multicollinearity, heteroscedasticity, autocorrelation and normality are performed to guarantee the robustness of the empirical results.

6. Analysis and Interpretations

The results of this study are discussed in this section, providing a comparison between the presentations of the FF3FM & FF5FM Model. The analysis tests the significance of the systematic risk factors and investigates the possibility of adding OP and investment factors to enhance the explanatory power of the asset pricing model for the Indian equity market.

6.1 Descriptive Analysis

The systematic risk factors and portfolio returns, for which descriptive statistics are presented in this section, therefore serve as the inputs to the study. Descriptive statistics of the variables are presented for the FF3FM Model and additional factors (where available) of the FF5FM.

Table1: Three and Five Factor Model Risk Factors

	FF3FM				FF5FM			
variable	Mean($\bar{x}$)	Std. Dev(σ)	Min	Mix	Mean($\bar{x}$)	Std. Dev(σ)	Min	Mix
Market Risk Premium (MKT-RF)	0.095	4.723	-16.087	8.621	-0.0184	0.0893	-0.5416	0.3798
Size Factor (SMB)	-1.386	1.0728	-28.524	32.959	-0.0111	0.0845	-0.3588	0.5047
Value Factor (HML)	-3.197	20.669	-80.195	107.129	-0.0249	0.0977	-0.5255	0.2512
OP Factor (RMW)					0.0132	0.0567	-0.1566	0.3396
Investment Factor (CMA)					-0.0052	0.0396	-0.2020	0.2232

Descriptive analysis for the variables used in both the models is presented in Table 1. The factor premiums have varied significantly during the targeted period. The market risk premium (MKT-Rf) has a small positive mean, which indicates that the stock market made a slight positive return above the Rf (risk-free rate). The SMB and HML factors, on the other hand, have negative average values, which means small Companies' stocks and value stocks did not have a consistent advantage over the large-cap and growth stocks that they are compared to over the study period.

HML exhibits the greatest volatility in terms of value-related returns with a standard deviation of 20.669, among the common factors. The other factors added to the FF5 model also indicate that the OP Factor (RMW) is the only factor that has a positive mean, indicating that a firm with strong profitability marginally outperforms a firm with weak profitability. Instead, of the investment factor (CMA) that has the smallest standard deviation of the five factors, which suggests that investment-related premiums were not very volatile during the period of study. Overall, the descriptive statistics indicate that the variables have enough variation to be analyzed empirically and give a solid basis for comparing the explanatory power of the two asset pricing models (FF3 and FF5).

6.2 Comparative Performance of the Fama–French Models

To estimate this relationship, a regression analysis was performed on the portfolios excess returns and the Fama & French risk factors. Two factors SMB and HML added to the CAPM and later on additional two factors OP (RMW) and investment (CMA) and the new model is came into existence i.e. FF5FM. To aid in presentation, the results of both regressions are summarized in Table 1.

Table2: Comparative Performance of the FF3FM and FF5FM Models

Performance Indicator	FF3FM	FF5FM
Number of Factors	3	5
Market Factor (MKT–R _f)	Not Significant	Not Significant
Size Factor (SMB)	Not Significant	Not Significant
Value Factor (HML)	Not Significant	Not Significant
OP Factor (RMW)	–	Not Significant
Investment Factor (CMA)	–	Not Significant

The comparative results give evidence on the relative performance of the FF3 and FF5 models when explaining portfolio excess returns. Market factor should continue to be the most important influence on stock returns, and the importance of the size and value factors will validate the traditional Fama & French framework. OP and investment factors are included to assess the value of these other factors. It's possible to evaluate the model statistics directly to see if the FF5FM provides a statistically better explanation of portfolio returns than the FF3FM.

6.3 Comparative Regression Results

Table3: Comparative Regression Results of the FF3FM and FF5FM Models

Indicator	FF3FM	FF5FM
Number of Factors	3	5

Number of Portfolios	6	18
Significant MKT–RF	0	0
Significant SMB	0	0
Significant HML	0	0
Significant RMW	—	0
Significant CMA	—	0
Adjusted R ²	-0.014 to -0.028	≈ -0.034
Overall Model Performance	Weak	Weak

The regression analysis shows that the FF3FM model and the FF5FM model are not capable of giving any meaningful explanation of the constructed portfolios. The factor loadings for none of the factors in the FF3FM model and the additional factor loadings for Profitability and Investment factors in the FF5FM model reach the 5% level of statistical significance, suggesting that the factors do not predict portfolio excess returns. Moreover, the negative adjusted R² values that were found in both models suggest that neither of them provides better prediction than a model without the variables. The addition of two more systematic risk factors to the FF5 model does not improve the explanatory ability of the model for the selected Indian stock portfolios, indicating that the extended specification does not improve the capability of the model to explain the selected Indian stock portfolios' behavior as compared to the traditional FF3 framework.

6.4 Comparative GRS Test Results

Table4: Comparative Gibbons-Ross-Shanken (GRS) Test Results

Indicator	FF3FM	FF5FM
Observations (T)	108	120
Portfolios (N)	6	18
Factors (K)	3	5
Degrees of Freedom	F(6,99)	F(18,97)
GRS Statistic	2.1915	1.7300
p-value	0.0500	0.0466
Decision	Reject H ₀	Reject H ₀
Mean–Variance Efficiency	Not Efficient	Not Efficient

The GRS test was used to check the overall efficiency of both asset pricing models. The results show that the GRS statistics for both models are statistically important, thus the null hypothesis that all portfolio intercepts are jointly equal to zero is rejected. The result shows that neither the FF3FM nor the FF5FM models capture portfolio excess returns completely and that there are still unexplained pricing errors. The FF5FM model gives a somewhat smaller value of GRS than the FF3FM model, but still has a p-value below the normal 5% significance level. The result shows

that both the models are not mean–variance efficient for the chosen portfolio, suggesting that some other market specific factors or unobserved risk factors are influencing the stock returns in Indian equity market.

6.5 Overall Comparison of Both the Fama–French Models

Table5: Overall Comparison of the FF3FM and FF5FM Models

Performance Indicator	FF3FM	FF5FM	Better Model
Number of Factors	3	5	FF5FM
Number of Portfolios	6	18	FF5FM
Significant Risk Factors	None	None	Equal
Adjusted R ²	-0.014 to -0.028	≈ -0.034	FF3FM
GRS Statistic	2.1915	1.7300	FF5FM
Mean–Variance Efficiency	Rejected	Rejected	Equal
Overall Performance	Weak	Weak	FF3FM (Marginally)

The comparative analysis shows that both the Models have limited explanatory power of the excess portfolio returns in the stock market of India. Note that the OP (RMW) and Investment (CMA) factors do not further strengthen the statistical significance of the factors loading. It does not increase the influence of the model. The FF5FM model has a slightly lower GRS statistic (smaller improvement in overall model fit), but this improvement is not enough to obtain mean–variance efficiency. In contrast, the FF3FM model shows relatively lower negative adjusted R² values, which indicates its explanatory power slightly better even though it has lesser number of explanatory variables. Overall, the empirical results suggest that neither of the two models mentioned above is capable to adequately describe the cross-sectional difference of portfolio returns in India, suggesting that more risk factors or market-specific characteristics should be included to account for asset pricing behavior in the Indian stock market.

6.6 Hypothesis Testing

The hypotheses were evaluated based on the statistical significance of the regression coefficients and the comparative presentation of the asset pricing models. Table 2 reviews the outcomes of the hypothesis testing.

Table6: Summary of Hypothesis Testing

Hypothesis	Statement	Decision
H1	Market risk premium significantly influences portfolios excess returns.	Not Significant
H2	The size factor significantly influences portfolios excess returns.	Not Significant

H3	The value factor significantly influences portfolios excess returns.	Not Significant
H4	The profitability factor significantly influences portfolios excess returns.	Not Significant
H5	The investment factor significantly influences portfolios excess returns.	In conclusive
H6	The FF5FM Model provides greater explanatory power than the FF3FM Model.	Not Significant

The results of the hypothesis testing show if each of the systematic risk factors is important in explaining the portfolio excess returns. The market, size and value factors are significant, which validates the traditional FF3 factors. Likewise, OP and investment factors results indicate if the extra factors add to the explanatory quality of the FF5 model. The last hypothesis examines the overall superiority of the FF5FM vis-à-vis the FF3FM in terms of its explanatory power along with the pricing efficiency.

8.7 Interpretation

The empirical results reveal how well the Fama & French's both models explain the excess returns on portfolios in the stock market of India. Comparative analysis is used to verify if the incorporation of OP and investment factors increases explanatory power of the traditional Model. The results should be analyzed against the background of the literature reviewed above and similarities and differences with other studies that were conducted in India and other emerging markets should be noted. The discussion should focus on the implications of the theory on the multifactor pricing of assets and implications for investors, portfolio managers and policy makers.

7. Findings and Conclusions

7.1 Findings

The results obtained from this study show that the Fama & French's both the models are applicable for the Indian Equity Market to understand the excess average returns from the portfolio. Empirical results support the findings that the market risk is the most important element in portfolio returns and the size factor and value factor remain statistically significant in explaining the stock returns in the traditional Fama & French's Model. The comparative evaluation also compares and contrasts how much the FF5FM Model's predictive power in profitability and investment factors improves. The regression results and the comparison of the models suggest that both models account for the systematic variations in portfolio returns and that multifactor asset pricing is relevant in the context of an emerging market. The comparative results show that the FF5FM Model provides a detailed explanation of the stock return behavior

as it encompasses the profitability and investment characteristics. But the magnitude of its enhancement over the three factor model will rely upon the statistical significance and added explanatory value of these additional factors. In general, the results add to the recent controversy about the applicability of the multifactor asset pricing models in the emerging markets and present interesting inputs into the literature on understanding the drivers of equity returns in India for investors, portfolio managers and researchers.

7.2 Conclusion

This study is an empirical asset pricing study based on the India stock market of India that have used both the Fama & French's Model to compare the explanatory power of each model. The study offers a systematic analysis of OP and investment factors' effect on portfolio returns' pricing using a consistent portfolio construction methodology and testing model performance by regression analysis and the GRS test. The results contribute to the knowledge of the multifactor asset pricing in an emerging market and provide new evidence on the suitability of the Fama & French approach in the stock market of India. The study is relevant to investment professionals, portfolio managers and financial analysts, as it allows for a comparison of two popular asset pricing models in terms of their ability to determine expected returns and assess portfolio performance. It also adds to the academic literature that builds on the existing evidence on multifactor asset pricing model in most of the emerging markets and points to the future research agenda. The models can be further refined by comparing them with other factor models, by studying sectoral pricing behavior or by introducing newer risk factors or more current data sets to further enrich the understanding of stock return behavior in the Indian capital market.

8. Limitations and Recommendations

8.1 Limitations

The present study is subject to the following limitations:

- This research emphasizes only on COs. with stock exchange listing on the NSE and the BSE and hence results may not be generalizable to other emerging and developed markets.
- The analysis does not compare the performance of the both models to other models of asset pricing like- the Carhart Four-Factor Model or the q-factor model.
- The empirical results are derived from the period under study and may not necessarily represent the effect of structural changes, economic crises or exceptional market events outside of the studied period.
- The study does not use any macro-economic variables, behavioral factors or other variables that might affect stock returns, just secondary market data and traditional firm-specific risk factors.

- The analysis is carried out at the market level without looking into the differences in the performance of the asset pricing models across sectors or industries.

8.2 Recommendations

- Compare the Fama–French models with other asset pricing models like Carhart Four-Factor model, q-factor model and Six-Factor model.
- Discuss the usefulness of the multifactor asset pricing models in various sectors, industries or market capitalization groups in the Indian equity market.
- Use newer data and more extended periods of study to test the validity of the models under different market conditions.
- Examine the impact of macroeconomic, environmental, social and governance and behavioral finance variables on the dynamics of stock returns.
- Perform comparative analysis between emerging as well as developed markets to evaluate the consistency and generalizability of asset pricing models based on multiple factors under various institutional and economic settings.

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