Article

Are Fama–French Factors Relevant? A Sub-Sectorial Analysis

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Abstract

The purpose of the study is to empirically examine the sectoral-specific performance of the five-factor asset pricing model comprising of 17-years' data in the Indian stock market using the Fama–French methodology. The results highlighted the better performance of a five-factor model in the "Basic Material" and "Oil" industries. However, for the "consumer" industry, there is an existence of other risk factors which can better explain the portfolio's excess returns. The result further demonstrates the better explanatory power of the five-factor model in explaining the portfolio excess return for the "Industrial" sector. However, the findings support the better applicability of market mode for the "financial" sector in the Indian stock market. For the "Health Care" and "Technology" industries, the addition of two more risk factors does not lead to much improvement in the model's explanatory power. The current study evaluating the applicability of the asset pricing model will have a practical implication for portfolio managers, policymakers, researchers, and academicians in evaluating the performance of the portfolios on a sectoral basis and in determining the cost of equity in the overall cost of capital. The study will also aid the investors in their investment decision-making by helping them to identify the average stock return in different sectors.

Keywords

Asset pricing model, Fama–French, sectors, risk factors, Indian stock market

JEL Classification: C22, F65, G4, G11, G12

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Introduction

Financial management revolves around various decisions, particularly, capital budgeting, capital structure, and dividend decisions. The cost of equity is considered as a heart or a center point of attraction for all these decisions. Thus, the correct estimation of the cost of equity is crucial in order to make vital decisions like whether to invest in a particular company or not or whether to undertake a particular project or not. The correct estimation of equity is vital for both the companies as well as for the investors. In the finance literature, there is an existence of various model which can assist in the calculation of the cost of equity. One such prominent model to calculate the cost of equity is Capital Asset Pricing Model (CAPM). The CAPM was introduced in the 1960s by Treynor (1961), Sharpe (1964), Linter (1965), and Mossin (1966) depicting the direct and linear relationship between the security's expected return and market risk. CAPM was considered as a follower of modern portfolio theory which was introduced by Harry Markowitz in 1964. The theory investigates the relationship between the financial asset's risk and expected return. In continuation of Harry Markowitz's theory, CAPM attempts to capture the relationship between the expected return and market risk. Failure of CAPM in capturing the security's expected returns has led to the development of alternative versions of CAPM such as zero beta version of CAPM, consumption-oriented CAPM, and multi-beta CAPM. The introduction of multi-beta CAPM by Ross (1976) in the 1980s has led to the development of a plethora of research specifying the presence of various other risk factors which can explain the security's expected returns. Thus, in order to improve the explanatory power of the model, various asset pricing models have been empirically developed and tested by the researchers. But the end of the 20th century marked the arrival of one of the famous multifactor models called the Fama–French three-factor model. Fama and French (1993) included market, size, and value risk factors. But the failure of the three-factor model in capturing the anomalies such as accrual anomaly, profitability, and investment anomaly has led to the development of the Fama–French five-factor model which incorporates profitability and investment risk factor along with the market, size, and value risk factors (Fama & French, 2015). With the advent of the five-factor model, various research are forgoing in the finance literature with regard to the testing of the five-factor model amongst various nations. Numerous researchers have tested the empirical applicability and the explanatory power of the five-factor model in the Indian stock market. The present research tries to go one step ahead by testing the sectoral-specific applicability of one of the widely used five-factor model in the Indian stock market. The objective of the research article is to identify the risk factors which can capture the size, value, profitability, and investment risk factors amongst various sectors of India. The study also tries to shed a light that whether the five-factor asset pricing model has a sectoral orientation or not in India. Also, because of different industry characteristics, the same model may not be universally applicable across various sectors of India. Thus, findings will give an opportunity to examine the in-depth validity of the asset pricing model in India. It tries to address an important research question, that is, whether a five-factor model can explain industrial returns in India. It will also assist the portfolio managers to build a portfolio of those companies belonging to

compute the industry-specific cost of capital, and thereby will help them in evaluating the performance of their sectoral-specific portfolios. The study will also assist the mutual fund managers in their investment decision-making as it helps them to identify the average stock returns in various sectors.

Literature Review

The CAPM which was introduced by Treynor (1961), Sharpe (1964), Linter (1965), and Mossin (1966) in their empirical findings independently found out that security's expected returns are explained by market risk factor and degree of sensitivity of security return to market return is being measured by "beta" of a security. However, with the passage of time, it was found that security's expected returns are not merely the function of the market risk factor but can also be explained by various other factors. Merton's (1973) Intertemporal CAPM and Ross's (1976) arbitrage pricing theories were two such models which gave a direction towards the path of the multifactor asset pricing model. Failure of CAPM to explain the size and value anomaly has led to the development of a three-factor model comprising of the market, size, and value risk factor (Fama & French, 1992). However, the three-factor model still lacked in explaining the momentum anomaly which has led to the emergence of the Carhart four-factor model. There existed a large body of literature with regard to testing of the explanatory power of the three-factor model amongst various nations. Gaunt (2004) empirically tested the applicability of size effect, value effect, and Fama–French three-factor model in the Australian stock market and highlighted the improved explanatory power of the three-factor model. The authors also highlighted the important role of the value factor in asset pricing in the Australian stock market. However, despite of recommendations from the academic world, Bartholdy and Peare (2005) found the inferior performance of a three-factor model in the U.S. stock market for the study period from 1970 to 1996. The outperformance of the three-factor model over the traditional CAPM has also been found in the Indian stock market by Bartholdy and Peare (2005). Similar evidences were being reported by Taneja (2010) and Aldaarmi et al. (2015) in the Indian and Saudi Arabian stock markets, respectively. Walid (2009) in his paper provided stronger support for the characteristic model rather than Fama–French three-factor model in explaining return dynamics of the Japanese stock market. The inferior performance of the four-factor model is also being witnessed by Nartea et al. (2009) in the New Zealand stock market. Similar evidence of the weaker performance of the four-factor model was found in the Italian stock market by Brighi et al. (2010). The period also witnessed the introduction of liquidity augmented three-factor model which is another effort being done (Chen et al., 2011) in the Chinese stock market wherein the results revealed the better explanatory power of the new four-factor model. Later on, similar evidences were quoted by Bhattacharya et al. (2020) who documented a liquidity-based asset pricing model in the Indian stock market using high-frequency data after controlling for up and down market, volatility, and effect of derivatives trading. Bhattacharya et al. (2021) further found the importance of illiquidity during periods of extreme high and low returns in the

Indian stock market. Further, the existence of a large body of literature that emphasized the importance of profitability and investment risk factors in explaining the security's expected returns has led to the development of a five-factor asset pricing model. Supported by the theoretical justification, Fama and French (2015) introduced the five-factor asset pricing model comprising of profitability and investment risk factors along with the market, size, and value risk factor. Various studies were conducted with regard to the testing of the five-factor model in various stock markets of the world (Chiah et al., 2015; Elliot et al., 2016; Huynh, 2017; Jain & Singla, in press; Khudoykulov, 2020). The availability of limited literature on the sectoral performance of the five-factor asset pricing model in the Indian stock market and inconclusive research with the regard to the five-factor model in such a market inspires us to study the sectoral-based testing of five-factor model performance in the context of Indian stock market.

The following objectives have been studied in this article:

1. To examine the market, size, value, profitability, and investment effect amongst various sectors of the Indian stock market.
2. To examine the explanatory power of the three, and five-factor asset pricing model amongst the various industries.

Data and Research Methodology

Data

The study tests the sectoral-specific applicability of the five-factor model in India by considering NSE 500 companies as a broad market index for the sample period from March 2002 to June 2019. All the NSE 500 companies are categorized into various sectors namely Basic Materials, Consumer Goods, Financials, Health Care, Industrial, Oil & Gas, and Technology. Sectors particularly Consumer services, Telecommunications, and Utilities are excluded for the select sample period as the number of companies belonging to such sectors falls short for the portfolio formation purpose. The study considers the monthly stock price and accounting data of each company belonging to different sectors of India. The sector-specific data have been retrieved from the *Bloomberg database*. For each sector, the study further excludes companies with a negative book value of equity and market value of equity (BE/ME) ratio, with missing stock price and accounting data. For the estimation and analysis purpose, the data is being converted into monthly simple return series using the following formula:

$$R_t = \frac{(P_t - P_{t-1})}{P_{t-1}},$$

where R_t = return on stock I for month t;
P_t = closing stock price in period t; and
P_{t-1} = closing stock price in period t–1.

The stylized portfolios are formed on the basis of size (measured by market cap), BE/ME ratio, profit before tax (PBT)/BE, and growth in total assets.

The study employs 91 days T-bill as a proxy for the risk-free rate of return and NSE 500 as a proxy for the market portfolio.

Methodology

The study adopts Davis et al. (2000) and Chan et al. (1991) methodology of portfolio construction. The study adopts portfolio analysis instead of individual security analysis in order to avoid measurement accuracy problems as it is difficult to estimate the betas of individual securities with high degrees of accuracy because of potential structural and cyclical changes (Fama & French, 2004). The study further adopts a single sorting procedure of portfolio formation because of the paucity of securities belonging to each sector.

For each sector, the ranking of all companies included in such sector is being made in ascending order on the basis of June-end market capitalization. The ranked sample companies for each sector have been named as P1S, P2S, P3S, P4S, and P5S. P1S portfolio consists of small size companies, while P5S constitutes stock price data of big size companies. A similar single sorting procedure is being repeated for BE/ME ratio wherein portfolios sorted on the basis of value factor have been named as P1V, P2V, P3V, P4V, and P5V. Similarly, stocks belonging to their respective sector are ranked on the basis of the PBT/BE ratio which is the proxy for the profitability factor. The portfolio sorted on the basis of profitability has been named as P1P, P2P, P3P, P4P, and P5P. Ranking in the ascending order is also being made for the formation of investment sorted portfolios. Growth in the total asset has been used as a proxy for investment which leads to the resultant portfolios, namely P1I, P2I, P3I, P4I, and P5I. All the portfolios are rebalanced on annual basis, and then monthly portfolio excess return and market index return have been calculated for the study period from July 2003 to June 2019.

For the construction of risk factors, namely SMB, HML, RMW, and CMA, the study employs a single sorting procedure. SMB risk premium has been defined and calculated as the monthly return difference between the small stock (P1S) and the big size portfolio (P5S). Similarly, the HML risk premium has been defined and calculated as the monthly return difference between the high-value (P5V) and low-value portfolio (P1V). The monthly return difference between the robust (P5P) and weak profitability portfolio (P1P) have been used for the calculation of the RMW risk premium. Similarly, the CMA risk premium has been defined and calculated as the monthly return difference between the conservative (P1I) and aggressive investment portfolio (P5I).

The relationship between the portfolio excess return and various risk factors is represented by the following:

Fama–French Three-Factor Model

$$R_{it} - R_f = \alpha_i + \beta(R_M - R_f) + s_i \mathrm{SMB}_t + h_i \mathrm{HML} + e_{it}, \quad (1)$$

where R_{it} means a return of portfolio i on month t, and R_f represents risk-free rate of return. SMB is the size factor, HML the value factor, RMW is the profitability

factor and CMA as investment factor, while α_i is defined as the intercept term and β, s, v, r and c measure the sensitivities of various factors, and e_{it} is the error term.

Fama–French Five-Factor Model

$$R_{it} - R_f = \alpha_i + \beta (R_M - R_f) + s_i \text{SMB}_t + h_i \text{HML} + r_i \text{RMW} + c_i \text{CMA} + e_{it} \quad (2)$$

Empirical Results

Table 1 represents the monthly excess returns of the portfolio sorted on the basis of size, value, profitability, and investment risk factors for different sectors of the

Table 1. Descriptive Statistics of Portfolio Excess Returns

Portfolio	Mean	*SD*	*SE* (Mean)	*T* (Mean)	Portfolio	Mean	*SD*	*SE* (Mean)	*T* (Mean)
Panel A: Basic materials					Panel B: Consumer goods				
P1S	0.032	0.1114	0.0078	4.0934	P1S	0.0306	0.0992	0.007	4.3857
P2S	0.0233	0.9062	0.0636	0.3669	P2S	0.0228	0.0971	0.0068	3.3441
P3S	0.0239	0.1193	0.0084	2.8497	P3S	0.0171	0.0844	0.0059	2.8909
P4S	0.0124	0.0921	0.0065	1.9231	P4S	0.0185	0.0723	0.0051	3.6352
P5S	0.0099	0.1066	0.0075	1.3285	P5S	0.0134	0.0604	0.0042	3.1511
P1V	0.0201	0.0751	0.0053	3.8207	P1V	0.0189	0.0626	0.0044	4.2908
P2V	0.0165	0.0974	0.0068	2.415	P2V	0.023	0.0762	0.0053	4.295
P3V	0.0115	0.0918	0.0064	1.7873	P3V	0.0186	0.0823	0.0058	3.2164
P4V	0.0259	0.1199	0.0084	3.0751	P4V	0.0176	0.0926	0.0065	2.7138
P5V	0.0343	0.1351	0.0095	3.6128	P5V	0.0254	0.1049	0.0074	3.4488
P1P	0.0174	0.1098	0.0077	2.2619	P1P	0.0172	0.096	0.0067	2.546
P2P	0.0192	0.1215	0.0085	2.2533	P2P	0.0193	0.0961	0.0067	2.8598
P3P	0.0191	0.1092	0.0077	2.4872	P3P	0.0238	0.0863	0.0061	3.924
P4P	0.0166	0.0921	0.0065	2.5621	P4P	0.0232	0.0756	0.0053	4.3719
P5P	0.035	0.1508	0.0106	3.3038	P5P	0.0198	0.0618	0.0043	4.5555
P1I	0.0233	0.1095	0.0077	3.0359	P1I	0.0189	0.0838	0.0059	3.2068
P2I	0.0182	0.0926	0.0065	2.7967	P2I	0.0217	0.089	0.0062	3.4757
P3I	0.0166	0.1042	0.0073	2.2756	P3I	0.0182	0.068	0.0048	3.8241
P4I	0.0192	0.1091	0.0077	2.5034	P4I	0.0177	0.0829	0.0058	3.0379
P5I	0.0112	0.1464	0.0103	1.0871	P5I	0.0255	0.086	0.006	4.2236
Panel C: Financials					Panel D: Health care				
P1S	0.0235	0.104	0.0073	3.2145	P1S	0.0241	0.0897	0.0063	3.8241
P2S	0.0137	0.0991	0.007	1.9772	P2S	0.0175	0.0798	0.0056	3.1279
P3S	0.0132	0.0968	0.0068	1.9456	P3S	0.0152	0.0756	0.0053	2.8646
P4S	0.0109	0.1066	0.0075	1.4628	P4S	0.0142	0.0704	0.0049	2.8684
P5S	0.0123	0.0996	0.007	1.759	P5S	0.0099	0.0659	0.0046	2.1378
P1V	0.0179	0.0891	0.0063	2.8673	P1V	0.0156	0.0705	0.0049	3.154
P2V	0.0152	0.0997	0.007	2.1683	P2V	0.0102	0.0638	0.0045	2.2816
P3V	0.0166	0.094	0.0066	2.5108	P3V	0.0146	0.069	0.0048	3.0224
P4V	0.0131	0.1047	0.0073	1.7771	P4V	0.0214	0.0805	0.0056	3.7869
P5V	0.0136	0.1226	0.0086	1.5773	P5V	0.0177	0.0943	0.0066	2.6743
P1P	0.0152	0.1083	0.0076	1.9995	P1P	0.0094	0.0855	0.006	1.5715
P2P	0.0127	0.1103	0.0077	1.6357	P2P	0.0205	0.0819	0.0058	3.5675
P3P	0.0134	0.0974	0.0068	1.9531	P3P	0.0154	0.073	0.0051	3.0066

(Table 1 continued)

(Table 1 continued)

Portfolio	Mean	*SD*	*SE* (Mean)	*T* (Mean)	Portfolio	Mean	*SD*	*SE* (Mean)	*T* (Mean)
P4P	0.0176	0.0933	0.0065	2.6803	P4P	0.0154	0.069	0.0048	3.1794
P5P	0.017	0.0957	0.0067	2.5314	P5P	0.0196	0.0682	0.0048	4.0911
P1I	0.0121	0.1009	0.0071	1.715	P1I	0.0147	0.073	0.0051	2.8702
P2I	0.018	0.1037	0.0073	2.47	P2I	0.015	0.0775	0.0054	2.767
P3I	0.0122	0.0943	0.0066	1.8353	P3I	0.0177	0.0691	0.0048	3.6499
P4I	0.0128	0.0904	0.0063	2.0154	P4I	0.0152	0.0801	0.0056	2.7051
P5I	0.0192	0.1147	0.008	2.3811	P5I	0.0176	0.0773	0.0054	3.2502
Panel E: Industrial					Panel F: Oil				
P1S	0.0339	0.129	0.0091	3.7377	P1S	0.003	0.1112	0.0078	0.3809
P2S	0.0187	0.0903	0.0063	2.9595	P2S	0.0053	0.1118	0.0078	0.6715
P3S	0.0197	0.0865	0.0061	3.2432	P3S	0.0092	0.0935	0.0066	1.394
P4S	0.0154	0.089	0.0062	2.4722	P4S	0.0158	0.1087	0.0076	2.0723
P5S	0.0152	0.0801	0.0056	2.7006	P5S	0.009	0.0873	0.0061	1.4727
P1V	0.0201	0.0819	0.0057	3.5007	P1V	0.0081	0.113	0.0079	1.0162
P2V	0.0167	0.0831	0.0058	2.8713	P2V	0.0054	0.0931	0.0065	0.8286
P3V	0.0266	0.1108	0.0078	3.4184	P3V	0.0157	0.1035	0.0073	2.1602
P4V	0.019	0.1057	0.0074	2.5667	P4V	0.0076	0.1094	0.0077	0.9911
P5V	0.0317	0.1432	0.0101	3.1511	P5V	0.0051	0.108	0.0076	0.6733
P1P	0.0255	0.1372	0.0096	2.6447	P1P	0.0185	0.1084	0.0076	2.4248
P2P	0.0159	0.0894	0.0063	2.5304	P2P	0.006	0.1063	0.0075	0.8068
P3P	0.0261	0.1046	0.0073	3.562	P3P	0.0063	0.0986	0.0069	0.9125
P4P	0.0175	0.0796	0.0056	3.141	P4P	0.0044	0.1055	0.0074	0.5946
P5P	0.0241	0.0798	0.0056	4.2971	P5P	0.0082	0.0964	0.0068	1.2068
P1I	0.0212	0.1171	0.0082	2.5773	P1I	0.0091	0.1091	0.0077	1.1846
P2I	0.0216	0.0887	0.0062	3.4638	P2I	0.0174	0.104	0.0073	2.3863
P3I	0.0188	0.0874	0.0061	3.0579	P3I	0.0078	0.1034	0.0073	1.0785
P4I	0.0194	0.0793	0.0056	3.4875	P4I	0.0053	0.1023	0.0072	0.7334
P5I	0.0222	0.0977	0.0069	3.2397	P5I	0.0051	0.0941	0.0066	0.7709
Panel G: Technology					Panel G: Technology				
P1S	0.0277	0.1265	0.0089	3.1251	P1P	0.0214	0.1192	0.0084	2.5552
P2S	0.0245	0.1063	0.0075	3.2773	P2P	0.0151	0.0926	0.0065	2.3254
P3S	0.0116	0.1096	0.0077	1.5074	P3P	0.0146	0.0971	0.0068	2.1456
P4S	0.0118	0.0954	0.0067	1.7646	P4P	0.0196	0.0942	0.0066	2.9706
P5S	0.0128	0.0735	0.0052	2.4817	P5P	0.0107	0.0804	0.0056	1.8961
P1V	0.0149	0.0807	0.0057	2.6219	P1I	0.0134	0.1098	0.0077	1.7446
P2V	0.0156	0.0894	0.0063	2.4796	P2I	0.0222	0.1062	0.0075	2.9759
P3V	0.016	0.097	0.0068	2.3482	P3I	0.0159	0.0872	0.0061	2.6051
P4V	0.0183	0.1083	0.0076	2.4067	P4I	0.0193	0.0893	0.0063	3.0784
P5V	0.0219	0.1342	0.0094	2.3247	P5I	0.013	0.103	0.0072	1.8054

Source: The authors.

Indian stock market. Except for the "oil" sector, the result indicates the higher mean monthly excess returns for the small stock portfolio in comparison to the large stock portfolios for all the sectors. This indicates the outperformance of small over the mega-stock portfolios. For the portfolio sorted on the basis of value, the mean monthly excess returns of high-value portfolios (P1V) were found to be higher than that of low-value portfolios (P1V) for all the industries except for the "Financial" and "Oil" sectors which shows a different trend pattern.

The portfolios sorted on the basis of profitability also indicate the increasing pattern of mean monthly excess returns with the increase in firm's profitability for the majority of the sectors, particularly "Basic Materials," "Consumer Goods," "Financials," and "Health Care." However, no specific pattern is indicated in the "Industrial," "Oil," and "Technology" sectors. In the case of portfolios sorted on the basis of investment risk factors, the mean monthly portfolio excess return exhibits a diminishing trend with a movement from P1I to P5I for the "Basic Material," "Oil" and "Technology" sectors. The descriptive results indicate the outperformance of conservative over aggressive investment portfolios. However, the increasing trend is witnessed for the other industries.

The results of Table 2 highlight the summary statistics of factor returns, namely market, size, value, profitability, and investment risk factors. The market premium for all the sectors is found to be 0.93% per month and is about 11.8% per annum. For the "Basic Material" industry, the SMB, HML, RMW, and CMA premiums are reported to 2.21%, 1.41%, 1.75%, and 1.22%, respectively, per month. The "Consumer Goods" industry indicated the positive size (1.72% per month), value (0.65% per month), and profitability premium (0.26% per month). However, investment premium (–0.66% per month) comes out to be negative in this industry showing a weak or no investment effect in the "Consumer Goods" industry. The descriptive results of the "Financial" sector indicate positive SMB and RMW risk premium of 1.12% per month and 0.18% per month, respectively. However, the risk premiums for the value and investment risk factors are found to be negative. In the "Health Care" sector, size, and profitability risk premium are reported to be positive and significant. The HML risk premium has also been reported to be positive (0.21% per month) but insignificant (t(mean) = 0.45). The descriptive results further reported a negative investment premium of –0.29% per month. For the "Industrial" sector, SMB and HML risk premium are found to be positive. However, RMW (–0.14% per month) and CMA risk premium (–0.10% per month) are reported to be negative for the "Industrial" sector. The "Oil" sector reports a negative SMB, HML, and RMW risk premium of –0.61%, –0.30%, –1.03%, respectively, while CMA risk premium is reported to be positive. The "Technology" sector indicates the positive SMB, HML, and CMA risk premium of 1.49%, 0.70%, and 0.04%, respectively, per month while the risk premium appears to be negative for the RMW risk factor (–1.07% per month).

Table 3 sheds a light on the regression results of the Fama–French three-factor model. It is evident from the results that with the incorporation of two more risk factors, a significant reduction in the alpha value is being observed. The presence of positive and significant alpha denotes the possibility of other risk factors which have the capacity to affect the portfolio's excess returns. Thus, after controlling for the market, size, and value risk factors, alpha values are found to be statistically insignificant. In terms of model performance, as indicated by the adjusted R^2, the result highlights the outperformance of the three-factor over one-factor asset pricing model for the industries, namely Basic Materials, Consumer Goods, Health Care, Industrial, Oil, and Technology. The result indicated the improved explanatory power for such industries.

Table 2 shows the regression results of the Fama–French five-factor model for various sectors. Regressing monthly portfolio excess returns on the five-factor

Table 2. Summary Statistics of Factor Returns

Portfolios	Mean	*SD*	*SE* (Mean)	*T* (Mean)	Portfolios	Mean	*SD*	*SE* (Mean)	*T* (Mean)
Panel A: Basic materials					Panel B: Consumer goods				
Market	0.0093	0.0695	0.0049	1.9088	Market	0.0093	0.0695	0.0049	1.9088
SMB	0.0221	0.1043	0.0073	3.0144	SMB	0.0172	0.0795	0.0056	3.0786
HML	0.0141	0.7473	0.0524	0.2688	HML	0.0065	0.0857	0.006	1.0878
RMW	0.0175	0.8929	0.0627	0.2797	RMW	0.0026	0.0765	0.0054	0.4844
CMA	0.0122	0.8749	0.0614	0.1987	CMA	–0.0066	0.0497	0.0035	–1.902
Panel C: Financials					Panel D: Health care				
Market	0.0093	0.0695	0.0049	1.9088	Market	0.0093	0.0695	0.0049	1.9088
SMB	0.0112	0.0657	0.0046	2.4216	SMB	0.0142	0.0679	0.0048	2.9756
HML	–0.0044	0.0767	0.0054	–0.8101	HML	0.0021	0.0648	0.0045	0.4586
RMW	0.0018	0.0623	0.0044	0.4117	RMW	0.0101	0.0655	0.0046	2.2068
CMA	–0.007	0.0589	0.0041	–1.6959	CMA	–0.0029	0.0618	0.0043	–0.6757
Panel E: Industrial					Panel F: Oil				
Market	0.0093	0.0695	0.0049	1.9088	Market	0.0093	0.0695	0.0049	1.9088
SMB	0.0187	0.1018	0.0071	2.6141	SMB	–0.0061	0.1015	0.0071	–0.8501
HML	0.0116	0.1162	0.0082	1.4176	HML	–0.003	0.1105	0.0078	–0.3818
RMW	–0.0014	0.0997	0.007	–0.1983	RMW	–0.0103	0.104	0.0073	–1.4086
CMA	–0.001	0.0818	0.0057	–0.181	CMA	0.004	0.0975	0.0068	0.5825
Panel G: Technology					Panel G: Technology				
Market	0.0093	0.0695	0.0049	1.9088	RMW	–0.0107	0.098	0.0069	–1.5536
SMB	0.0149	0.0903	0.0063	2.3571	CMA	0.0004	0.094	0.0066	0.0604
HML	0.007	0.1203	0.0084	0.8332					

Source: The authors.

model for the "Basic Materials" industry leads to a slight improvement in the regression intercepts. The regression intercepts of the five-factor model are found to be more shrink towards zero in comparison to the three-factor model regression intercepts for the "Basic Material" industry. The intercepts of the five-factor model are not found to be distinguishably different from zero and, thus, leads to non-rejection of the null hypothesis of intercepts being equal to zero. Similar evidence are revealed from the "Health Care" and "Technology" sectors showing a marginal decline in the regression intercept value with a movement from the three-to five-factor model. Parallel results are also witnessed for the "Consumer Goods" industry. However, the presence of significant abnormal returns in the regression results of the specific industry highlights the presence of other risk factors not covered by the five-factor model but have the capacity to affect the portfolio's excess return. In terms of the explanatory power of a model, the average adjusted R^2 of Basic Materials, Consumer Goods, Health Care, Industrial, Oil, and Technology are found to be 75.4%, 77.4%, 82.6%, 55.4%, 80.4%, 61.6%, and 53.3%, respectively. The result shows a better explanatory power of the five-factor model for all the specific sectors. There appears to be a marginal improvement in the asset pricing model performance with the inclusion of two more risk factors, namely profitability and investment in the "Health care" and "Technology" sectors.

Table 3. Regression Results of Three-Factor Model

Portfolios	a	β	s	h	Adjusted R^2	Portfolios	a	β	s	h	Adjusted R^2
	t(a)	*t*(β)	*t*(s)	*t*(h)			*t*(a)	*t*(β)	*t*(s)	*t*(h)	
Panel A: Basic materials						Panel B: Consumer goods					
P1S	0.004	0.76*	0.687*	–0.025	0.811	P1S	0.009*	0.553*	0.671*	–0.026	0.905
	1.193	23.389	20.874	–0.766			3.958	21.48	25.99	–0.908	
P2S	0.033	0.093*	0.056	–0.883*	0.809	P2S	0.008*	0.623*	0.229*	0.215*	0.736
	1.109	2.839	1.688	–27.489			2.236	14.468	5.299	4.438	
P3S	0.012	0.665*	0.043	0.034	0.42	P3S	0.04	0.781*	0.197*	0.035	0.757
	1.813	11.689	0.741	0.61			1.446	18.928	4.749	0.763	
P4S	0.003	0.835*	–0.065	–0.027	0.725	P4S	0.009*	0.839*	0.139*	–0.07	0.712
	0.903	21.346	–1.644	–0.713			2.957	18.669	3.087	–1.38	
P5S	0.004	0.795*	–0.261*	–0.026	0.793	P5S	0.009*	0.909*	–0.213*	–0.043	0.744
	1.193	23.389	–7.579	–0.766			3.958	21.48	–5.023	–0.908	
P1V	0.02	0.098*	0.038*	–0.956*	0.942	P1V	0.009*	0.865*	0.456*	–0.689*	0.701
	1.45	5.437	2.081	–53.831			3.43	18.905	9.945	–13.392	
P2V	0.005	0.875*	0.014	0.095*	0.759	P2V	0.012*	0.866*	0.142*	–0.039	0.79
	1.462	23.858	0.375	2.629			4.624	22.566	3.679	–0.879	
P3V	0.002	0.816*	–0.005	0.061	0.662	P3V	0.007*	0.745*	0.167*	0.078	0.717
	0.46	18.795	–0.105	1.421			2.12	16.718	3.74	1.558	
P4V	0.006	0.825*	0.278*	0.08	0.64	P4V	0.003	0.706*	0.257*	0.108*	0.766
	1.114	18.412	6.135	1.802			0.893	17.428	6.321	2.368	
P5V	0.02	0.378*	0.146*	0.147*	0.135	P5V	0.009*	0.516*	0.272*	0.406*	0.894
	1.45	5.437	2.081	2.153			3.43	18.905	9.945	13.224	
P1P	0.026	0.31*	0.07	0.154*	0.093	P1P	0.003	0.674*	0.215*	0.205*	0.794
	1.499	4.357	0.977	2.203			0.78	17.755	5.633	4.811	
P2P	–0.003	0.822*	0.359*	0.114*	0.654	P2P	0.005	0.739*	0.189*	0.158*	0.818
	–0.512	18.727	8.084	2.634			1.544	20.665	5.265	3.926	
P3P	0.01	0.613*	0.019	0.007	0.36	P3P	0.011*	0.688*	0.182*	0.144*	0.71
	1.48	10.263	0.308	0.113			3.319	15.271	4.037	2.844	

P4P	0.007	0.845*	–0.029	–0.01	0.722
	1.827	21.463	–0.719	–0.248	
P5P	0.023	0.1*	0.048*	–0.948*	0.929
	1.318	5.031	2.408	–48.5	
P1I	0.009	0.633*	0.163*	–0.157*	0.41
	1.496	11.033	2.816	–2.777	
P2I	0.005	0.819*	0.17*	0.017	0.626
	1.178	17.945	3.668	1.586	
P3I	0.004	0.863*	0.036	0.035	0.726
	0.968	22.103	0.923	0.911	
P4I	0.003	0.806*	0.232*	0.095*	0.605
	0.495	17.17	4.874	2.052	
P5I	0.018	0.106*	0.051*	–0.946*	0.929
	1.009	5.293	2.496	–48.022	
Panel C: Financials					
P1S	0.006*	0.792*	0.403*	0.195*	0.872
	2.316	29.604	14.977	7.108	
P2S	0.004	0.767*	0.043	0.268*	0.742
	1.157	20.219	1.136	6.895	
P3S	0.006	0.776*	–0.049	0.311*	0.797
	1.741	23.042	–1.452	9.013	
P4S	0.003	0.795*	–0.084*	0.278*	0.804
	0.798	24.061	–2.54	8.22	
P5S	0.006*	0.827*	–0.238*	0.203*	0.86
	2.316	29.604	–8.467	7.108	
P1V	0.006*	0.931*	0.016	–0.106*	0.832
	2.213	30.459	0.53	–3.388	
P2V	0.005	0.84*	–0.009	0.165*	0.787
	1.467	24.404	–0.247	4.691	

P4P	0.012*	0.742*	0.219*	0.042	0.716
	3.961	16.638	4.89	0.845	
P5P	0.009*	0.765*	0.497*	–0.566*	0.612
	3.306	14.677	9.518	–9.668	
P1I	0.007*	0.633*	0.192*	0.248*	0.76
	2.195	15.436	4.67	5.391	
P2I	0.008*	0.719*	0.244*	0.095*	0.759
	2.403	17.495	5.913	2.055	
P3I	0.009*	0.769*	0.173*	0.027	0.708
	3.134	17.015	3.821	0.525	
P4I	0.003	0.785*	0.424*	–0.273*	0.696
	0.909	17.032	9.165	–5.258	
P5I	0.013*	0.725*	0.216*	0.067	0.712
	3.697	16.139	4.796	1.327	
Panel D: Health care					
P1S	0.008*	0.535*	0.541*	–0.015	0.723
	2.157	13.187	12.651	–0.359	
P2S	0.009*	0.572*	0.138*	0.145*	0.469
	2.025	10.187	2.326	2.436	
P3S	0.006	0.677*	0.103	0.141*	0.591
	1.775	13.756	1.991	2.707	
P4S	0.008	0.649*	0.024	0.053	0.446
	1.951	11.317	0.392	0.868	
P5S	0.008*	0.728*	–0.294*	–0.021	0.486
	2.157	13.187	–5.056	–0.359	
P1V	0.006	0.752*	0.196*	–0.339*	0.585
	1.895	15.147	3.75	–6.426	
P2V	0.004	0.657*	0.042	0.015	0.447
	1.14	11.477	0.69	0.241	

(Table 3 continued)

(Table 3 continued)

Portfolios	a *t*(a)	β *t*(β)	s *t*(s)	h *t*(h)	Adjusted R^2
P3V	0.008* 2.182	0.789* 20.876	0.007 0.175	0.229* 5.908	0.744
P4V	0.003 0.832	0.76* 22.332	0.077* 2.259	0.328* 9.396	0.792
P5V	0.006* 2.212	0.677* 30.459	0.012 0.53	0.548* 24.086	0.911
P1P	0.005 1.48	0.765* 22.312	0.032 0.921	0.322* 9.177	0.789
P2P	0.003 0.928	0.77* 22.736	–0.009 –0.256	0.322* 7.272	0.794
P3P	0.005 1.525	0.777* 23.632	0.006 0.166	0.32* 9.493	0.806
P4P	0.008* 2.412	0.806* 22.032	0.022 0.59	0.21* 5.596	0.76
P5P	0.005 1.449	0.851* 22.804	0.081* 2.164	0.075 1.965	0.754
P1I	0.002 0.717	0.799* 24.33	0.033 0.99	0.279* 8.294	0.806
P2I	0.01* 2.842	0.758* 22.917	–0.014 –0.415	0.351* 10.343	0.804
P3I	0.005 1.421	0.758* 21.69	–0.023 –0.64	0.328* 9.147	0.781
P4I	0.004 1.103	0.81* 22.973	0.041 1.145	0.225* 6.226	0.777
P5I	0.005 1.112	0.862* 24.374	0.101* 2.844	0.085* 2.353	0.776
Panel E: Industrial					
P1S	0.007* 2.666	0.235* 28.608	0.969* 63.455	–0.042* –2.701	0.988

Portfolios	a *t*(a)	β *t*(β)	s *t*(s)	h *t*(h)	Adjusted R^2
P3V	0.008 1.986	0.618* 10.846	0.084 1.405	0.081 1.339	0.452
P4V	0.011* 2.57	0.604* 10.806	0.225* 3.818	–0.018 –0.297	0.473
P5V	0.006 1.895	0.562* 15.147	0.147* 3.75	0.434* 11.002	0.768
P1P	–0.001 –0.171	0.604* 12.74	0.137* 2.747	0.266* 5.289	0.621
P2P	0.01* 2.58	0.66* 13.048	0.16* 2.989	0.09 1.666	0.568
P3P	0.007 1.799	0.621* 10.992	0.138* 2.318	0.036 0.6	0.462
P4P	0.008* 2.027	0.66* 11.518	0.126* 2.083	–0.109 –1.789	0.446
P5P	0.013* 3.207	0.594* 9.648	0.091 1.397	–0.058 –0.882	0.36
P1I	0.006 1.574	0.551* 9.828	0.182* 3.081	0.135* 2.27	0.469
P2I	0.006 1.434	0.639* 11.993	0.157* 2.795	0.07 1.238	0.522
P3I	0.01* 2.634	0.609* 10.577	0.131* 2.151	0.033 0.536	0.44
P4I	0.007 1.783	0.679* 12.671	0.016 0.287	0.105 1.849	0.515
P5I	0.007 1.953	0.692* 13.558	0.165* 3.628	–0.047 –0.866	0.56
Panel F: Oil					
P1S	–0.002 –0.598	0.639* 21.071	0.632* 17.933	0.123* 3.42	0.832

P2S	0.005	0.837*	0.332*	0.257*	0.739	P2S	–0.002	0.645*	0.247*	0.276*	0.531
	1.89	21.936	4.686	3.582			–0.343	12.711	4.181	4.599	
P3S	0.008*	0.843*	0.195*	0.155*	0.725	P3S	0.001	0.706*	0.028	0.088	0.475
	2.417	21.557	2.693	2.109			0.137	13.157	0.447	1.389	
P4S	0.004	0.9*	0.028	0.019	0.807	P4S	0.008	0.648*	0.149*	0.108	0.424
	1.53	27.457	0.461	0.309			1.272	11.519	2.278	1.615	
P5S	0.007*	0.912*	–0.169*	–0.162*	0.817	P5S	–0.002	0.814*	–0.356*	0.157*	0.728
	2.666	28.608	–2.861	–2.701			–0.598	21.071	–7.938	3.42	
P1V	0.008	0.237*	0.586*	–0.435*	0.931	P1V	–0.003	0.671*	0.128*	–0.467*	0.733
	1.448	12.058	16.051	–11.746			–0.621	17.538	2.881	–10.316	
P2V	0.006	0.878*	0.115	0.051	0.762	P2V	–0.004	0.756*	0.096	–0.015	0.57
	1.949	24.144	1.706	0.741			–0.788	15.565	1.726	–0.253	
P3V	0.009	0.651*	0.671*	0.575*	0.577	P3V	0.007	0.643*	0.08	0.041	0.4
	1.713	13.417	7.445	6.284			1.262	11.218	1.202	0.598	
P4V	0.008	0.682*	0.105	0.09	0.465	P4V	–0.001	0.726*	0.207*	0.215*	0.579
	1.435	12.496	1.037	0.878			–0.202	15.098	3.698	3.771	
P5V	0.008	0.45*	1.112*	1.271*	0.75	P5V	–0.003	0.702*	0.134*	0.534*	0.708
	1.448	12.058	16.051	18.07			–0.621	17.538	2.881	11.248	
P1P	0.002	0.69*	0.76*	0.662*	0.682	P1P	0.011	0.584*	0.055	0.239*	0.346
	0.327	16.505	9.737	8.354			1.722	9.76	0.796	3.367	
P2P	0.003	0.871*	0.282*	0.245*	0.799	P2P	–0.002	0.653*	0.062	0.41*	0.506
	0.952	26.065	4.536	3.894			–0.316	12.548	1.024	6.643	
P3P	0.016*	0.666*	0.106	0.058	0.435	P3P	–0.003	0.757*	0.03	0.043	0.554
	2.666	11.883	1.021	0.544			–0.705	15.306	0.53	0.742	
P4P	0.007*	0.849*	0.142*	0.142	0.741	P4P	–0.003	0.701*	0.325*	0.12*	0.59
	2.448	22.362	2.007	1.98			–0.633	14.784	5.894	2.133	
P5P	0.011	0.202*	0.61*	–0.406*	0.923	P5P	0	0.71*	0.261*	–0.16*	0.573
	1.829	9.747	15.825	–10.38			0.02	14.655	4.646	–2.792	
P1I	0.001	0.698*	0.722*	0.624*	0.668	P1I	0.001	0.704*	0.258*	0.187*	0.57
	0.289	16.228	9.035	7.703			0.193	14.501	4.567	3.252	
P2I	0.009*	0.807*	0.344*	0.335*	0.719	P2I	0.01	0.618*	0.119	0.011	0.377
	2.55	20.422	4.682	4.498			1.6	10.566	1.745	0.157	

(Table 3 continued)

(Table 3 continued)

Portfolios	a	β	s	h	Adjusted
	t(a)	*t*(β)	*t*(s)	*t*(h)	R^2
P3I	0.007*	0.87*	0.146*	0.106	0.763
	2.276	23.961	2.166	1.553	
P4I	0.005	0.184*	0.631*	–0.389*	0.931
	0.863	9.362	17.276	–10.511	
P5I	0.009*	0.881*	0.151*	0.108	0.782
	2.684	25.317	2.34	1.647	
Panel G: Technology					
P1S	0.009*	0.396*	0.724*	–0.116*	0.795
	2.262	11.019	17.45	–2.877	
P2S	0.013*	0.64*	0.141*	0.017	0.504
	2.41	11.441	2.183	0.28	
P3S	0.001	0.612*	0.054	0.083	0.439
	0.213	10.287	0.781	1.244	
P4S	0.004	0.646*	0.092	–0.215*	0.398
	0.659	10.473	1.295	–3.114	
P5S	0.009*	0.682*	–0.255*	–0.199*	0.393
	2.262	11.019	–3.566	–2.877	
P1V	0.008	0.737*	0.144*	–0.472*	0.563
	1.933	14.033	2.376	–8.046	
P2V	0.008	0.628*	0.064	–0.164*	0.37
	1.564	9.956	0.875	–2.326	
P3V	0.006	0.662*	0.154*	–0.041	0.512
	1.129	11.924	2.411	–0.668	
P4V	0.006	0.577*	0.356*	–0.177*	0.509
	1.049	10.355	5.546	–2.85	
P5V	0.008	0.443*	0.087*	0.612*	0.842
	1.933	14.033	2.376	17.334	

Portfolios	a	β	s	h	Adjusted
	t(a)	*t*(β)	*t*(s)	*t*(h)	R^2
P3I	0	0.627*	0.167*	0.058	0.4
	0.058	10.922	2.507	0.851	
P4I	–0.002	0.648*	0.126*	0.324*	0.528
	–0.479	13.445	2.131	5.374	
P5I	–0.005	0.77*	–0.02	0.051	0.573
	–1.024	15.904	–0.349	0.889	
Panel G: Technology					
P1P	0.008	0.426*	0.373*	0.089	0.51
	1.299	7.653	5.819	1.439	
P2P	0.005	0.73*	0.141*	–0.101	0.575
	1.095	14.092	2.355	–1.745	
P3P	0.004	0.63*	0.217*	–0.097	0.49
	0.815	11.101	3.307	–1.531	
P4P	0.012*	0.623*	0.078	–0.152*	0.372
	2.129	9.899	1.067	–2.164	
P5P	0.004	0.634*	0.097	–0.307	0.386
	0.924	10.18	1.348	–4.407	
P1I	0.003	0.545*	0.117	0.128	0.432
	0.471	9.102	1.699	1.918	
P2I	0.01	0.598*	0.243*	–0.045	0.496
	1.898	10.597	3.726	–0.719	
P3I	0.007	0.664*	0.119	–0.131	0.453
	1.578	11.306	1.759	–1.991	
P4I	0.011*	0.579*	0.2*	–0.232*	0.372
	2.156	9.193	2.747	–3.291	
P5I	0.001	0.632*	0.308*	–0.232*	0.52
	0.274	11.482	4.849	–3.778	

Source: The authors.
Note: * indicates significance at 5% level.

Table 4. Regression Results of the Fama–French Five-Factor Model

Portfolios	a *t*(a)	β *t*(β)	s *t*(s)	h *t*(h)	r *t*(r)	c *t*(c)	Adjusted R^2
Panel A: Basic materials							
P1S	0.004	0.760*	0.686*	–0.004	0.043	0.024	0.809
	1.196	23.037	20.196	–0.015	0.151	0.199	
P2S	0.017	0.067*	0.041*	–0.532*	–1.08*	–1.493*	0.974
	1.531	5.429	3.225	–5.429	–10.078	–34.012	
P3S	0.012*	0.719*	0.13*	–2.851*	–2.439*	0.504*	0.558
	2.049	14.338	2.516	–7.113	–5.563	2.807	
P4S	0.003	0.853*	–0.036	–0.997*	–0.898*	0.087	0.737
	0.885	22.047	–0.905	–3.225	–2.658	0.629	
P5S	0.004	0.795*	–0.261*	–0.004	0.045	0.025	0.791
	1.196	23.037	–7.354	–0.015	0.151	0.199	
P1V	0.012	0.089*	0.038*	–1.032*	–0.829*	–0.782*	0.986
	1.86	10.056	4.166	–14.644	–10.758	–24.779	
P2V	0.006	0.872*	0.005	0.399	0.462	0.160	0.759
	1.537	23.58	0.141	1.349	1.428	1.208	
P3V	0.002	0.817*	–0.006	0.105	0.185	0.146	0.66
	0.502	18.583	–0.122	0.299	0.483	0.928	
P4V	0.006	0.828*	0.288*	–0.246	–0.491	–0.167	0.639
	1.048	18.295	6.167	–0.681	–1.241	–1.031	
P5V	0.012	0.342*	0.146*	–0.145	–3.194*	–3.012*	0.797
	1.86	10.056	4.166	–0.534	–10.758	–24.779	
P1P	0.015*	0.286*	0.097*	–1.07*	–4.346*	–3.228*	0.875
	2.407	10.762	3.534	–5.031	–18.689	–33.904	
P2P	–0.002	0.828*	0.36*	0.136	0.447	0.441*	0.665
	–0.392	18.964	8.008	0.39	1.172	2.825	
P3P	0.009	0.682*	0.130*	–3.695*	–3.209*	0.563*	0.583
	1.777	13.993	2.599	–9.491	–7.538	3.227	
P4P	0.007	0.855*	–0.012	–0.544	–0.409	0.137	0.725
	1.841	21.626	–0.303	–1.72	–1.184	0.966	
P5P	0.015*	0.077*	0.026*	–0.288*	–0.168*	–0.869*	0.991
	2.407	10.762	3.534	–5.031	–2.679	–33.904	
P1I	0.009	0.691*	0.257*	–3.263*	–2.65*	0.516*	0.568
	1.713	13.948	5.045	–8.241	–6.12	2.913	
P2I	0.005	0.82*	0.169*	0.08	0.05	0.043	0.622
	1.183	17.686	3.55	0.213	0.123	0.257	
P3I	0.004	0.862*	0.028	0.337	0.596	0.302*	0.731
	1.093	22.071	0.706	1.08	1.746	2.156	
P4I	0.003	0.813*	0.239*	–0.12	0.033	0.261	0.607
	0.552	17.183	4.901	–0.317	0.08	1.54	
P5I	0.009	0.084*	0.031*	–0.399*	–0.324*	–0.913*	0.994
	1.713	13.948	5.045	–8.241	–6.12	–42.157	
Panel B: Consumer goods							
P1S	0.008*	0.558*	0.668*	–0.008	0.024	–0.005	0.904
	3.75	20.289	25.264	–0.193	0.641	–0.217	
P2S	0.008*	0.587*	0.239*	0.159*	–0.105	–0.063	0.741
	2.268	12.965	5.502	2.391	–1.721	–1.652	

(Table 4 continued)

(Table 4 continued)

Portfolios	a *t*(a)	β *t*(β)	s *t*(s)	h *t*(h)	r *t*(r)	c *t*(c)	Adjusted R^2
P3S	0.006	0.728*	0.225*	–0.115	–0.219*	–0.021	0.773
	1.946	17.152	5.504	–1.846	–3.816	–0.585	
P4S	0.008*	0.782*	0.148*	–0.113	–0.123*	–0.15*	0.737
	2.861	17.16	3.373	–1.684	–2.002	–3.911	
P5S	0.009*	0.916*	–0.219*	–0.013	0.039	–0.008	0.742
	3.75	20.289	–5.036	–0.193	0.641	–0.217	
P1V	0.008*	0.864*	0.447*	–0.64*	0.044	–0.056	0.702
	3.107	17.79	9.577	–8.991	0.678	–1.38	
P2V	0.012*	0.845*	0.147*	–0.066	–0.057	–0.043	0.79
	4.547	20.749	3.763	–1.112	–1.028	–1.241	
P3V	0.008*	0.696*	0.187*	–0.026	–0.168*	–0.053	0.727
	2.345	14.996	4.181	–0.386	–2.683	–1.358	
P4V	0.004	0.655*	0.281*	–0.024	–0.197	–0.031	0.779
	1.298	15.667	6.996	–0.386	–3.488	–0.888	
P5V	0.008*	0.516*	0.267*	0.435*	0.027	–0.034	0.895
	3.107	17.79	9.577	10.244	0.678	–1.38	
P1P	0.006*	0.559*	0.275*	–0.12*	–0.472*	–0.041	0.878
	2.422	17.976	9.198	–2.628	–11.234	–1.563	
P2P	0.005	0.723*	0.198*	0.106	–0.071	0.004	0.818
	1.728	19.03	5.427	1.902	–1.382	0.121	
P3P	0.011*	0.677*	0.181*	0.151*	–0.01	–0.045	0.709
	3.141	14.118	3.932	2.143	–0.151	–1.108	
P4P	0.012*	0.697*	0.23*	–0.016	–0.121	–0.094*	0.728
	3.961	15.009	5.159	–0.235	–1.939	–2.42	
P5P	0.006*	0.868*	0.427*	–0.186*	0.505*	–0.063	0.705
	2.422	17.976	9.198	–2.628	7.738	–1.563	
P1I	0.01*	0.658*	0.216*	0.111	–0.089	0.243*	0.816
	3.612	17.249	5.887	1.987	–1.729	7.582	
P2I	0.008*	0.664*	0.258*	0.022	–0.148*	–0.11*	0.777
	2.459	15.826	6.386	0.361	–2.615	–3.115	
P3I	0.009*	0.71*	0.196*	–0.094	–0.199*	–0.074	0.726
	3.407	15.247	4.378	–1.375	–3.173	–1.884	
P4I	0.003	0.815*	0.41*	–0.201*	0.11	0.024	0.698
	0.726	16.682	8.737	–2.815	1.662	0.584	
P5I	0.01*	0.641*	0.21*	0.108	–0.087	–0.341*	0.825
	3.612	17.249	5.887	1.987	–1.729	–10.894	
Panel C: Financials							
P1S	0.006*	0.759*	0.39*	0.218*	–0.023	–0.108*	0.879
	2.226	27.185	14.733	7.391	–0.702	–3.407	
P2S	0.004	0.722*	0.027	0.292*	–0.047	–0.143*	0.753
	1.036	18.138	0.703	6.923	–1.01	–3.17	
P3S	0.005	0.76*	–0.056	0.326*	–0.002	–0.052	0.797
	1.683	21.04	–1.645	8.532	–0.044	–1.264	
P4S	0.002	0.765*	–0.103*	0.334*	0.054	–0.102*	0.819
	0.72	22.407	–3.173	9.254	1.36	–2.654	

(Table 4 continued)

(Table 4 continued)

Portfolios	a *t*(a)	β *t*(β)	s *t*(s)	h *t*(h)	r *t*(r)	c *t*(c)	Adjusted R^2
P5S	0.006*	0.792*	–0.252*	0.228*	–0.024	–0.112*	0.868
	2.226	27.185	–9.132	7.391	–0.702	–3.407	
P1V	0.006*	0.887*	0	–0.087*	–0.056	0.141*	0.844
	2.108	28.001	0.013	–2.6	–1.525	3.934	
P2V	0.004	0.79*	–0.038	0.256*	0.084*	–0.17*	0.829
	1.448	23.82	–1.219	7.292	2.179	–4.526	
P3V	0.008*	0.767*	–0.006	0.266*	0.033	–0.073	0.749
	2.135	19.108	–0.155	6.265	0.709	–1.605	
P4V	0.003	0.745*	0.074*	0.319*	–0.052	–0.047	0.792
	0.774	20.383	2.15	8.245	–1.23	–1.125	
P5V	0.006*	0.644*	0	0.562*	–0.041	–0.102*	0.917
	2.108	28.001	0.013	23.075	–1.525	–3.934	
P1P	0.005	0.735*	0.045	0.193*	–0.343*	–0.073*	0.871
	1.7	25.161	1.637	6.237	–10.067	–2.212	
P2P	0.003	0.733*	–0.021	0.334*	–0.053	–0.115*	0.801
	0.81	20.51	–0.625	8.807	–1.278	–2.837	
P3P	0.005	0.746*	–0.015	0.384*	0.068	–0.109*	0.824
	1.488	22.214	–0.459	10.821	1.746	–2.87	
P4P	0.008*	0.758*	–0.006	0.292*	0.072	–0.162*	0.794
	2.444	20.878	–0.177	7.607	1.693	–3.949	
P5P	0.005	0.832*	0.051	0.218*	0.263*	–0.083*	0.83
	1.7	25.161	1.637	6.237	6.839	–2.212	
P1I	0.003	0.837*	0.061*	0.178*	–0.136*	0.131*	0.85
	0.953	26.955	2.061	5.414	–3.753	3.728	
P2I	0.009*	0.73*	–0.026	0.375*	–0.009	–0.09*	0.808
	2.771	20.809	–0.779	10.091	–0.215	–2.275	
P3I	0.005	0.743*	–0.041	0.408*	0.137*	–0.061	0.804
	1.457	20.963	–1.208	10.864	3.317	–1.51	
P4I	0.003	0.79*	0.022	0.3*	0.12*	–0.071	0.798
	1.1	21.982	0.654	7.888	2.859	–1.744	
P5I	0.003	0.736*	0.053*	0.157*	–0.12*	–0.399*	0.884
	0.953	26.955	2.061	5.414	–3.753	–12.891	
Panel D: Health care							
P1S	0.006	0.548*	0.547*	0.011	0.069	0.007	0.723
	1.746	12.907	12.738	0.232	1.5	0.182	
P2S	0.006	0.592*	0.149*	0.209*	0.145*	–0.021	0.48
	1.432	10.175	2.539	3.243	2.319	–0.382	
P3S	0.007	0.692*	0.104*	0.112	–0.025	0.09	0.596
	1.879	13.501	2.002	1.964	–0.453	1.861	
P4S	0.006	0.681*	0.034	0.071	0.089	0.081	0.449
	1.605	11.38	0.554	1.074	1.372	1.427	
P5S	0.006	0.746*	–0.2868	0.015	0.093	0.01	0.487
	1.746	12.907	–4.894	0.232	1.5	0.182	
P1V	0.005	0.772*	0.206*	–0.298*	0.106	0.011	0.588
	1.403	14.914	3.925	–5.194	1.9	0.226	

(Table 4 continued)

(Table 4 continued)

Portfolios	a *t*(a)	β *t*(β)	s *t*(s)	h *t*(h)	r *t*(r)	c *t*(c)	Adjusted R^2
P2V	0.003	0.691*	0.053	0.047	0.115	0.067	0.467
	0.715	11.576	0.882	0.706	1.78	1.187	
P3V	0.006	0.649*	0.095	0.111	0.106	0.06	0.456
	1.565	10.907	1.581	1.688	1.656	1.063	
P4V	0.011*	0.598*	0.224*	–0.017	–0.008	0.02	0.468
	2.51	10.168	3.759	–0.256	–0.13	–0.356	
P5V	0.005	0.577*	0.154*	0.464*	0.079	0.008	0.77
	1.403	14.914	3.925	10.819	1.9	0.226	
P1P	0.006	0.553*	0.109*	0.115*	–0.349*	0.039	0.713
	1.607	12.801	2.491	2.411	–7.496	0.957	
P2P	0.009*	0.68*	0.167*	0.117	0.081	0.027	0.568
	2.182	12.825	3.118	1.988	1.42	0.533	
P3P	0.005	0.642*	0.148*	0.083	0.119	0.007	0.467
	1.313	10.906	2.489	1.271	1.878	0.13	
P4P	0.006	0.689*	0.139*	–0.05	0.153*	0.016	0.457
	1.43	11.596	2.317	–0.761	2.385	0.289	
P5P	0.006	0.693*	0.137*	0.145*	0.523*	0.049	0.549
	1.607	12.801	2.491	2.411	8.957	0.957	
P1I	0.007*	0.649*	0.196*	0.041	0.009	0.449*	0.655
	2.053	13.709	4.093	0.783	0.183	10.019	
P2I	0.004	0.658*	0.168*	0.125*	0.129*	–0.013	0.529
	0.889	11.888	2.992	2.042	2.159	–0.239	
P3I	0.009*	0.62*	0.138*	0.074	0.091	–0.02	0.441
	2.224	10.289	2.259	1.111	1.397	–0.354	
P4I	0.005	0.726*	0.031	0.141*	0.144*	0.106*	0.531
	1.228	13.152	0.564	2.301	2.42	2.032	
P5I	0.007*	0.613*	0.185*	0.039	0.009	–0.376*	0.693
	2.053	13.709	4.093	0.783	0.183	–8.898	
Panel E: Industrial							
P1S	0.007*	0.241*	0.944*	–0.022	0.048	0.016	0.988
	2.672	27.24	43.727	–1.113	1.833	1.308	
P2S	0.005	0.792*	0.539*	0.158	–0.325*	–0.152*	0.748
	1.486	19.553	5.462	1.72	–2.729	–2.731	
P3S	0.007*	0.809*	0.401*	0.147	–0.22	–0.18*	0.737
	2.186	19.538	3.982	1.568	–1.808	–3.169	
P4S	0.004	0.874*	0.153	–0.036	–0.19	–0.094	0.809
	1.434	24.792	1.787	–0.446	–1.838	–1.936	
P5S	0.007*	0.936*	–0.266*	–0.087	0.185	0.062	0.819
	2.672	27.24	–3.181	–1.113	1.833	1.308	
P1V	0.004	0.293*	0.461*	–0.111*	0.497*	0.007	0.972
	1.164	21.847	14.128	–3.638	12.631	0.369	
P2V	0.005	0.854*	0.272*	0.058	–0.151	–0.141*	0.769
	1.723	22.015	2.88	0.664	–1.331	–2.658	
P3V	0.014*	0.562*	0.752*	–0.12	–0.873*	0.151*	0.797
	3.64	15.461	8.488	–1.458	–8.181	3.021	
P4V	0.008	0.66*	0.228	0.073	–0.144	–0.103	0.464
	1.327	11.175	1.583	0.548	–0.833	–1.276	

(Table 4 continued)

(Table 4 continued)

Portfolios	a *t*(a)	β *t*(β)	s *t*(s)	h *t*(h)	r *t*(r)	c *t*(c)	Adjusted R^2
P5V	0.004	0.556*	0.875*	1.887*	0.943*	0.013	0.901
	1.164	21.847	14.128	32.723	12.631	0.369	
P1P	0.007*	0.589*	0.925*	–0.055	–0.984*	0.084*	0.902
	2.154	23.323	15.024	–0.967	–13.268	2.427	
P2P	0.002	0.831*	0.522*	0.234*	–0.258*	–0.21*	0.817
	0.615	24.064	6.204	2.99	–2.546	–4.422	
P3P	0.015*	0.615*	0.362*	–0.032	–0.362*	–0.198*	0.447
	2.539	10.255	2.475	–0.234	–2.057	–2.403	
P4P	0.007*	0.801*	0.37*	0.039	–0.351*	–0.17*	0.753
	2.342	19.959	3.789	0.425	–2.978	–3.086	
P5P	0.007*	0.273*	0.429*	–0.026	0.618*	0.039*	0.979
	2.154	23.323	15.024	–0.967	17.968	2.427	
P1I	0.007*	0.652*	0.582*	–0.005	–0.573*	0.325*	0.908
	2.628	26.618	9.755	–0.085	–7.973	9.681	
P2I	0.008*	0.746*	0.647*	0.227*	–0.433*	–0.235*	0.742
	2.402	18.204	6.483	2.439	–3.601	–4.17	
P3I	0.006*	0.837*	0.338*	0.08	–0.225	–0.162*	0.772
	2.07	21.706	3.598	0.921	–1.99	–3.057	
P4I	0.001	0.248*	0.47*	–0.042	0.559*	0.031	0.978
	0.306	20.607	16.035	–1.525	15.841	1.879	
P5I	0.007*	0.781*	0.697*	–0.006	–0.686*	–0.447*	0.868
	2.628	26.618	9.755	–0.085	–7.973	–11.114	
Panel F: Oil							
P1S	–0.002	0.637*	0.623*	0.132*	0.028	0.014	0.831
	–0.52	20.914	16.87	3.374	0.853	0.409	
P2S	–0.003	0.635*	0.185*	0.262*	0.037	0.179*	0.557
	–0.479	12.851	3.086	4.145	0.698	3.291	
P3S	0.002	0.688*	–0.061	0.166*	0.252*	0.139*	0.556
	0.524	13.914	–1.023	2.624	4.774	2.555	
P4S	0.004	0.651*	0.141*	0.001	–0.207*	0.151*	0.463
	0.741	11.972	2.135	0.014	–3.572	2.53	
P5S	–0.002	0.811*	–0.368*	0.168*	0.035	0.017	0.727
	–0.52	20.914	–7.832	3.374	0.853	0.409	
P1V	–0.003	0.667*	0.1*	–0.484*	–0.004	0.092*	0.745
	–0.77	17.538	2.18	–9.926	–0.087	2.203	
P2V	–0.002	0.751*	0.086	0.055	0.152*	–0.054	0.585
	–0.392	15.719	1.488	0.891	2.978	–1.038	
P3V	0.006	0.641*	0.056	–0.008	–0.074	0.124	0.408
	0.996	11.235	0.805	–0.115	–1.206	1.972	
P4V	–0.002	0.719*	0.159*	0.183*	–0.014	0.163*	0.596
	–0.436	15.247	2.781	3.029	–0.277	3.15	
P5V	–0.003	0.698*	0.105*	0.517*	–0.004	0.096*	0.712
	–0.77	17.538	2.18	10.129	–0.087	2.203	
P1P	0.002	0.612*	0.146*	–0.055	–0.691*	0.121*	0.749
	0.6	16.465	3.233	–1.149	–17.387	2.95	
P2P	–0.001	0.646*	0.025	0.433*	0.086	0.068	0.514
	–0.216	12.48	0.402	6.524	1.548	1.197	

(Table 4 continued)

(Table 4 continued)

Portfolios	a *t*(a)	β *t*(β)	s *t*(s)	h *t*(h)	r *t*(r)	c *t*(c)	Adjusted R^2
P3P	–0.002	0.742*	–0.044	0.098	0.189*	0.13*	0.606
	–0.475	15.918	–0.787	1.635	3.797	2.545	
P4P	–0.001	0.691*	0.288*	0.202*	0.205*	–0.004	0.623
	–0.172	15.178	5.224	3.463	4.222	–0.089	
P5P	0.002	0.689*	0.164*	–0.062	0.303*	0.136*	0.682
	0.6	16.465	3.233	–1.149	6.776	2.95	
P1I	–0.001	0.677*	0.087*	0.143*	0.09*	0.501*	0.804
	–0.309	20.596	2.189	3.383	2.557	13.864	
P2I	0.005	0.627*	0.135*	–0.148*	–0.339*	0.151*	0.473
	0.895	11.644	2.06	–2.143	–5.889	2.558	
P3I	0.001	0.616*	0.111	0.074	0.093	0.128*	0.42
	0.101	10.903	1.617	1.026	1.54	2.055	
P4I	–0.002	0.681*	0.107	0.335*	0.042	0.036	0.526
	–0.426	13.321	1.732	5.117	0.774	0.636	
P5I	–0.001	0.785*	0.101*	0.165*	0.104*	–0.455*	0.736
	–0.309	20.596	2.189	3.383	2.557	–10.868	
Panel G: Technology							
P1S	0.009*	0.399*	0.703*	–0.163*	–0.082	0.045	0.798
	2.163	11.164	15.763	–3.598	–1.899	1.296	
P2S	0.013*	0.64*	0.082	–0.034	–0.152*	–0.009	0.513
	2.319	11.521	1.185	–0.479	–2.281	–0.167	
P3S	0.001	0.616*	0.053	0.046	–0.035	0.059	0.437
	0.173	10.308	0.706	0.611	–0.482	1.028	
P4S	0.003	0.652*	0.059	–0.305*	–0.142	0.097	0.411
	0.545	10.662	0.768	–3.934	–1.929	1.647	
P5S	0.009*	0.687*	–0.292*	–0.281*	–0.14	0.077	0.402
	2.163	11.164	–3.805	–3.598	–1.899	1.296	
P1V	0.007	0.737*	0.136*	–0.484*	–0.025	0.007	0.559
	1.899	13.951	2.063	–7.216	–0.391	0.128	
P2V	0.008	0.632*	0.036	–0.224*	–0.104	0.055	0.371
	1.483	10.007	0.455	–2.793	–1.369	0.898	
P3V	0.005	0.661*	0.093	–0.083	–0.147*	–0.03	0.521
	1.037	11.992	1.357	–1.182	–2.227	–0.555	
P4V	0.006	0.579*	0.361*	–0.197*	–0.009	0.041	0.505
	1.025	10.341	5.173	–2.776	–0.133	0.757	
P5V	0.007	0.444*	0.082*	0.65*	–0.015	0.004	0.84
	1.899	13.951	2.063	15	–0.391	0.128	
P1P	0.005	0.431*	0.148*	–0.166*	–0.636*	0.065	0.743
	1.124	10.685	2.947	–3.25	–13.132	1.681	
P2P	0.005	0.726*	0.086	–0.105	–0.103	–0.082	0.584
	1.049	14.135	1.336	–1.613	–1.676	–1.656	
P3P	0.004	0.636*	0.208*	–0.166*	–0.078	0.101	0.497
	0.733	11.261	2.948	–2.32	–1.15	1.858	
P4P	0.011*	0.623*	0.028	–0.188*	–0.122	–0.019	0.375
	2.056	9.893	0.357	–2.359	–1.61	–0.317	

(Table 4 continued)

(Table 4 continued)

Portfolios	a *t*(a)	β *t*(β)	s *t*(s)	h *t*(h)	r *t*(r)	c *t*(c)	Adjusted R^2
P5P	0.005	0.639*	0.22*	–0.247*	0.276*	0.097	0.436
	1.124	10.685	2.947	–3.25	3.842	1.681	
P1I	0.002	0.575*	0.193*	–0.113	–0.079	0.527*	0.679
	0.362	12.749	3.436	–1.982	–1.467	12.108	
P2I	0.01	0.601*	0.215*	–0.103	–0.101	0.052	0.498
	1.812	10.662	3.061	–1.433	–1.487	0.948	
P3I	0.007	0.667*	0.124	–0.156*	–0.014	0.051	0.45
	1.547	11.301	1.686	–2.087	–0.199	0.887	
P4I	0.01*	0.581*	0.107	–0.337*	–0.261*	0.028	0.405
	2.033	9.468	1.403	–4.326	–3.539	0.465	
P5I	0.002	0.613*	0.206*	–0.121	–0.085	–0.351*	0.635
	0.362	12.749	3.436	–1.982	–1.467	–7.568	

Source: The authors.
Note: * indicates significance at 5% level.

Conclusion

In this article, we tried to test the empirical applicability of the Fam-French five-factor model amongst various sectors of India with an objective to find out that whether the five-factor model can explain the industry's expected return or not. The results of sectoral-specific analysis for India shows that after controlling for risk factors, the profitability and value effect comes out to be non-existent in the "Basic Material" industry. The regression results of other industries exhibited moderate to strong size, value, profitability, and investment effect. The findings further stipulated that the five-factor model works well in the "Basic Material" and "Oil" industries. However, for the "consumer" industry, the five-factor model combining with market, size, value, profitability, and some other risk factors might work well. The result further demonstrated the better explanatory power of the five-factor model in explaining the portfolio excess return for the "Industrial" sector. However, there is still a possibility of other risk factors which can better explain the expected return in the "Industrial" sector. The result further showed that the one-factor model or model combining with market, value, and investment factors holds valid for the "Financials" sector in the Indian stock market. Results also highlighted the low explanatory power of the three-factor model in explaining the expected return in the "Health Care" industry while a better performance of a three-factor model is found in the "Technology" sector. As far as practical applications are concerned, the study will help the portfolio managers in evaluating the sectoral-specific performance of the portfolios and determining the cost of equity of various sectors of India. The study will also aid the investors in their investment decision-making by helping them to identify the average stock return in different sectors. The application of the asset pricing model will further assist the policymakers in making efforts for greater financial integration and long-term economic cooperation. The study will help the researchers to identify the additional

risk factor supported by theoretical evidence which can improve the explanatory power of a model. The future study can try to evaluate the sectoral-wise applicability of the asset pricing model in other emerging nations of the world.

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The authors declare that there is no conflict of interest.

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