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Research Article

Fama–French Three-Factor Versus Daniel-Titman Characteristics Model: A Comparative Study of Asset Pricing Models from India

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This study compares the three-factor model (F&F model) proposed by Eugene Fama and Kenneth French with Daniel and Titman's Characteristics Model (D&T model) using the data of Indian stock returns for the period of 25 years from 1993 to 2018. Three-way sorting ($3 \times 2 \times 2$) of stocks based on the B/M ratio and size of the firms, and then by SMB, HML, or ex-ante β loadings, is formulated to design thirty-six portfolios. Regression and rolling regression are applied to the data under study. Results obtained by the F&F model, despite its shortcomings, are found more conclusive than the D&T model for distinguishing between characteristics and covariances for returns on Indian stock. This study favors the F&F model over the D&T model.

1. Introduction

This study explores and compares Fama- French three factor model (F&F Model) with Daniel and Titman's characteristics model (D&T Model) using the data of Indian stock returns. F&F Model is a kind of Capital Asset Pricing Model (CAPM). The CAPM was initially developed by Sharpe[1] and Lintner [2]. It has been used as one of the most recognized models of asset pricing in the history of finance (Ross, Westerfield, and Jordan, 1996) since its development. However, in the late 1970s, it came under attack as many anomalous pricing patterns emerged from empirical research works which could not be explained by CAPM [3, 4]. Book to Market (B/M) equity ratio and Firm size (size) are two such anomalies that are relevant to this research work. Fama and French analyzed in 1992 that B/M equity ratio and size can record the cross-sectional differences in the rate of return better than beta. Fama and French were motivated by the findings of other researchers similar to these findings. They extended their research in the same field and proposed F&F Model in 1993 [5]. They added two additional portfolios of risk factors in already existing CAPM to record the B/M ratio and size premiums. However, this F&F model was questioned by Daniel and Titman [6] with their competing hypothesis, which put forth the following argument: It is not the price loadings on risk factors but the usual firm's characteristics with comparable B/M ratio and size that explicate variations (cross-sectional) in the stock returns. It is clear that the firms with the same characteristics, like size and B/M ratio, provide similar results due to their same level of risk exposure. According to Daniel and Titman [6], the problem is whether the B/M ratio or size are proxies for the risk-related factors which cannot be diversified and, consequently, can prompt the variations in the stock's returns [7].

The study was needed and had great importance in the field of CAPMs in the Indian context. It contributes and adds value to literature mainly in two ways. First, the F&F model is tested by using a long period (quarter of a century) data set of the Indian stock market and provides fresh evidence on whether B/M premium (value effect) and size premium (size effect) prevail in Indian Market [8]. Therefore, the results of this study provide an out-of-sample analysis of the F&F Model. Second, this work happens to be the first study using the data of the Indian market, which provides a comparison between the F&F and D&T models.

2. Review of Literature (Theoretical Framework)

2.1. Fama–French 3-Factor (F&F) Model. According to Fama and French [5], B/M ratio and size are the two factors of risk that should be rewarded. It was also suggested by them that the high B/M ratio and a high average return on small shares are a type of recompense for bearing distress risk. The duo created mimicking portfolios that record (expected) return premiums related to B/M ratio and size. Their model is mathematically demonstrated through the following equation:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p\left(R_{mt} - R_{ft}\right) + S_p\,(SMB)_t + h_p\,(HML)_t + \varepsilon_{pt}, \quad (1)$$

where *Rp* stands for the rate of return on portfolio *p*, Rf is the rate of return on the risk-free asset, Rm is market portfolio's rate of return, HML is the return on the portfolio mimicking for the value factor (B/M equity), and SMB is the return on the portfolio mimicking for the market capitalization (size).

The return on stocks is shown by two factors. The first factor is SMB which depicts Small minus Big (i.e., returns on small size market cap firms minus big size market cap firms). Another one is HML which means High minus Low (i.e., returns on high B/M equity firms minus low B/M equity firms). Fama and French [5] tested the F&F model by taking the following steps. They sorted (a) stocks based on size and (b) B/M equity into quintiles. Based on the same, they formed 25 more portfolios by using the intersection of sorted data. It is worth noting that Fama and Franch tested their model against the dependent variables. The time-series regressions are computed for every portfolio. They found in their research that all factor loadings on each of these three factors were significant in the case of all 25 portfolios. The implication of such loadings on SMB and HML factors was that they captured time-series variation in the expected returns, and it was clarified that the slopes which are obtained from time-series regressions on SMB and HML are the loadings on priced factors.

In a stream of related articles, Fama and French [9, 10] argue, following Merton's [11] Intertemporal CAPM (ICAPM) framework, that the discernible superior returns of size and value portfolios are the compensation for some extramarket risk. There is substantial evidence to suggest that the premiums earned by these fundamental risk characteristics are indeed pervasive across emerging and developed markets [10, 12–19]; Sehgal and Jain, 2011, [20, 21], and [22]. Momani [23], in his study on Amman stock Exchange, favors using Carhart Model over the F&F model in practical applications. Fathi et al. [24] study the influence of trading characteristics in the Tehran Stock Exchange and report these to be the main determinants of liquidity.

The evidence of the effects of size and B/M ratio led researchers to study the F&F model in the Indian context [25]. The F&F model was studied specifically for the Indian stock market for the first time by Connor and Sehgal [26], followed by Taneja [27], Sehgal and Balakrishnan [28], and Rossi [29]. All of them provided evidence in favor of the F&F model.

However, the literature is silent on whether it is the characteristics of the exposure to the risk factors which define cross-sectional variation in the mean of stock returns for the Indian stock market. In the recent studies over factor models, a new factor "human capital" has also been explored by Maiti and Balakrishnan [30]. Maiti [31] has conducted a review study on the evolution of risk factors in CAPMs and stressed that risk factors' evolution is a continuous process. Amihud [32], Amihud and Levi [33], and Adrian, Fleming, Shachar, and Vogt [34] have shown the effect of illiquidity on stock returns.

2.2. Daniel and Titman's Study Characteristic Model (D&T Model). Daniel and Titman's study (1997) is the first study that raised the questions on the inclusion of risk factors in the F&F model and argues that returns are better described by firm characteristics like firm size and B/M equity ratio than the factor loadings. According to them, the F&F model does not describe the average rate of returns directly. It describes average returns due to the correlation between factor loadings and firm Characteristics. Daniel and Titman formed portfolios by categorizing stocks according to B/M equity ratios and a second sort of factor loadings to unclasp the explanatory power of these two models. They reported results consistent with the mispricing story, as a powerful relation is observed between B/M equity ratio and expected rate of returns than between expected rate of return and factor loadings. They provided an argument that distressed stocks, which were exposed to a unique 'distress' factor, were not the reason behind the comovement of high B/M equity ratio stocks. It (comovement) was due to stocks with similar factor sensitivities, which tended to become distressed at the same time. It means that the results favored the characteristics of the firm model as opposed to the assumption of the factor of risk. Low B/M equity ratio, which is one of the characteristics of large firms, produces a low return, which cannot be, essentially, linked to a risk factor. Thus, Daniel and Titman's work supported the Characteristics of Firm Model (D&T model) as against the F&F model. D&T model also rejected the risk-based interpretations provided by Fama and French initially.

A response was provided to Daniel and Titman for their characteristics model by Davis, Fama, and French [35]. They perform the same investigation spanning 68 years (1929–1997). They executed a $3 \times 3 \times 3$ sort where they took size, B/M equity, and factor loading instead of $3 \times 3 \times 5$ sorts, which were used by Daniel and Titman because of this long time period, availability of data of very less number of firms was available. To confirm that this study is not prejudiced to reject the Characteristics Model, they show that the HML premiums come out to be comparable over different periods. For the period from 1929 to 1997, HML is 0.46 percent per month, and for the period from 1973 to 1993, it is 0.50 percent per month. Both the premiums are significant statistically.

They report varying results for the period (1973–1993) taken by Daniel and Titman for their analysis and for the extended period, that is, 1929–1997. Hence, similar to the results provided by Daniel and Titman in 1997, Davis et al. [35] also supported Characteristics Model but only over 20 years. But when the period of study is extended, they observe that the F&F model cannot be rejected or disapproved. Thus, they provided an argument that the interpretation of Daniel and Titman is subsample-specific and demonstrate their results to be consistent with the F&F model.

Similarly, Lewellen [36], in his study, also found that Fama–French Model is superior to the Titman Model. On the other hand, Ferson and Harvey [37] presented in their study that the F&F model is unable to explain the conditional expected returns.

Daniel, Titman, and Wei [38] provided the very first evidence from outside of the USA by studying the Japanese stock market, and the French Stock market was studied by Lajili-Jarjir [7].

Daniel et al. [38] provided the evidence which supports the story of the D&T model, while Lajili and Jarjir [7] found evidence that favors of F&F model.

To respond to the findings provided by Davis et al. [35], in favor of the F&F model, Daniel et al. [38] replicated the same testing on Japan's data for the period spanning 1975–1997. Their results suggest that the value premium in average stock returns of Japan's Stocks was more vigorous than in the USA. Consistent with Daniel and Titman's findings, they reveal that characteristics and not the factor loadings explain the stock returns in Japan and they find out some key differences between evidence from Japan and USA. They discarded the F&F model in all those experiments that construct characteristic-balanced portfolios with HML factor loading. The results of Daniel and Titman's study are more realistic because they did not accept those characteristic-balanced portfolios which have the loadings on the market, SMB, and HML factors [39].

Gharghori et al. [40] conduct an investigation of the F&F model versus the D&T Model on Australian data. They approved the F&F model as against D&T Model. Lajili-Jarjir [7] also tested both models using data from the stock market of France. They formed portfolios based on the triple sort on B/M ratio, size, and then by ex-ante beta, SMB, or HML loadings, and the results of this study rejected the F&F model. However, regression tests of this study favored the F&F model. Fieberg et al. [41] tried to explain that the characteristics (covariance) make-up of returns explicates the cross-sectional variation in German stock returns. Their results report that widely accepted factors like HML, WML, or SMB were not priced. This observation became inconsistent with the literature available currently, which claimed that these factors should be priced. They found that B/M equity and characteristics momentum explained the differences at a cross-sectional level, and returns on the stocks confirm the findings/results [42, 43]; (Schiereck et al., 1999).

Further, their results report the lack of size effect. That is, firm size does not define the returns at cross-sectional. This finding supports the recent literature on Germany [42, 44]. It was also pointed out in this study that cross-sectional dispersion in average stock returns for the stock market of Germany can be explained by characteristics instead of exposure to the risk factors. So, they reported their results consistent with Daniel and Titman's findings and the findings of [38].

3. Data and Methodology

3.1. Data. This section focuses on the data utilized for conducting this research. The relevant data of the S&P BSE-500 index for the period July 1993 to June 2018 is obtained from Prowess, the Reserve Bank of India's weekly auction database (http://www.rbi.org.in), and BSE Sensex. The Prowess, which is a database maintained by the Centre for Monitoring Indian Economy (CMIE), provided the data of monthly closing prices on common stocks, market capitalization, and price-to-book ratio for each month of the sample period.

The monthly closing prices of common stocks were used to calculate monthly return data. While S&P BSE-500 index covers about 90 percent of the total market capitalization and trading activities in the Indian stock market, and hence, it fairly represents market performance. Market capitalization is used as a measure of company size, and the price-to-book value ratio is inversed to obtain the B/M equity ratio (BE/ME). BE/ME is used to construct a value factor to be used as one of the variables in the study [45, 46].

Firms having negative BE are excluded while reckoning the breakpoints for the B/M equity ratio. Reserve Bank of Inida's weekly auction data is used to compute the rate of the 91-day treasury bill. A risk-free rate is obtained by converting the implicit yields into the monthly rate of return. The rate of return of BSE stocks served as the market return proxy. Finally, to calculate the market risk premium, the risk-free rate was reduced from the monthly rate of return on the market portfolios.

The average number of business firms considered in the study across years is given in Table 1. The number of firms taken for the analysis significantly rises from the year 1993 to the year 2016. The minimum number of firms analyzed during any one year is 157 for the year 1993, and the maximum number of firms is 496 for the year 2018. Stocks of the rest of the firms were excluded due to incomplete or missing data on some variables.

The sample for the study of the D&T model spans from July 1993 to June 2018. However, the main analysis is from July 1996 to June 2018, as prior data for three years is used to measure the preformation factor loadings. The main idea behind taking the data up to 2018 was to make a round figure of 25 years when we originally started working on this manuscript in 2020.

The number of firms ranges between 157 and 496 between 1993–1994 and 2017–2018. The average number of firms/stocks is 311.

3.2. Methodology

3.2.1. Portfolios Sorting Based on Size and Book-to-Market. In June of each year, stocks are sorted on their market capitalization in increasing order and grouped into two types of

Table 1: Number of stocks in the sample across years.

Year	Number of business firms	Year	Number of business firms
1993–1994	157	2006–2007	307
1994–1995	180	2007–2008	327
1995–1996	198	2008–2009	350
1996–1997	216	2009–2010	354
1997–1998	222	2010–2011	365
1998–1999	231	2011–2012	380
1999–2000	234	2012–2013	383
2000–2001	243	2013–2014	385
2001–2002	246	2014–2015	477
2002–2003	253	2015–2016	481
2003–2004	262	2016–2017	490
2004–2005	269	2017–2018	496
2005–2006	282		

portfolios "small and big" by the median (Therefore, the breakpoint for constructing "size portfolios" is 50% based on median). Then these small and big portfolios are sorted into three groups by their ranked book equity to market equity ratio (value portfolios) at the end of the previous financial year (i.e., March). These value portfolios are broken down into three groups at the breakpoints of top 30% (High), middle 40% (Medium), and bottom 30% (low). Six test portfolios named small-high (SH), small-medium (SM), small-low (SL), big-high (BH), big-medium (BM), and big-low (BL) are made (mimicking to F&F model 1993) with the intersection of size (big/small) and B/M Ratio (High/Medium/Low). Two portfolios, named as "high minus low" (HML) and "Small minus Big" (SMB), are formed further from these six portfolios.

$$SMB = \frac{(SL - BL) + (SM - BM) + (SH - BH)}{3},$$
$$HML = \frac{(SH - SL) + (BH - BL)}{2}. \quad (2)$$

3.2.2. Construction of Triple-Sorted Portfolios Based on Factor Loadings by Using Rolling Regression. To test Titman Model, all six portfolios formed on independent B/M ratio and size are further sorted into two portfolios based on preformation HML slopes. This $3 \times 2 \times 2$ sort on B/M ratio, size, and HML loadings (low and high) produces a total of 12 portfolios that are known as the dependent variables, the same as Fama–French regression. This portfolio formation process is repeated for the remaining two factors in the Fama–French model, that is, SMB and market factor. Hence, a total of three sets of 12 portfolios each are formed on HML, SMB, and market factor loadings (Figure 1).

Following Daniel and Titman [6], the preformation factor slopes are prepared by doing *rolling regression* on returns of every stock of the three-factor portfolios (HML, SMB, and Market) of Fama–French for the period starting from −35 to 0 relative to the date of portfolio formation.

After constructing these three sets of portfolios, we begin our tests of the F&F model by using the methodology of Daniel and Titman. First, we analyze the returns on the 12 B/M equity, size, and market factor loading portfolios. According to Daniel and Titman's Characteristics Model, the returns which are expected from low and high factor loading portfolios are the same because their factor risk does not carry any reward. Alternatively, the F&F model envisions that average returns of the high factor loading portfolios are more than the portfolios with low loadings because the prior are rewarded for higher risk. If the difference in portfolio returns between high and low factor loadings (i.e., h–l) is positive and significant, the D&T model will get the rejection against the F&F model.

3.2.3. Construction of Characteristics-Balanced Portfolios. We perform a formal inspection of the F&F model against the D&T model, the same as it was conducted by Deniel and Titman (1997) in their study. This inspection is based on the significance level and the time-series regression of the returns of D&T model portfolios on the returns of the F&F model portfolios.

Returns of D&T model portfolios are also computed. It is computed by reducing the low factor loading from high factor loading (h–l) portfolios of each B/M ratio group size. Accordingly, a set of six CB portfolios were composed against every set of factor-loading portfolios. There were a total of three sets of factor loading portfolios. Therefore researcher got a total of three sets of characteristic-balanced portfolios, where each set consisted of 6 stocks.

It was predicted by the F&F model that the regressions' intercepts of the returns of CB portfolios on the F&F model portfolios cannot be distinguished from zero. On the contrary, the D&T model reveals that the value of h–l (intercepts) in the time-series regression should be negative.

According to the anticipation of the D&T model, the mean rate of return of CB portfolios must be distinguishable from zero because these CB portfolios also present the short as well as the long asset having the same characteristics. On the other hand, the F&F model says that the returns of these portfolios should be positive.

4. Results and Discussion

It is examined whether expected returns generated by the F&F model are better described by factor loadings or by firm characteristics. Furthermore, a comparative analysis of the F&F model and D&T model is conducted.

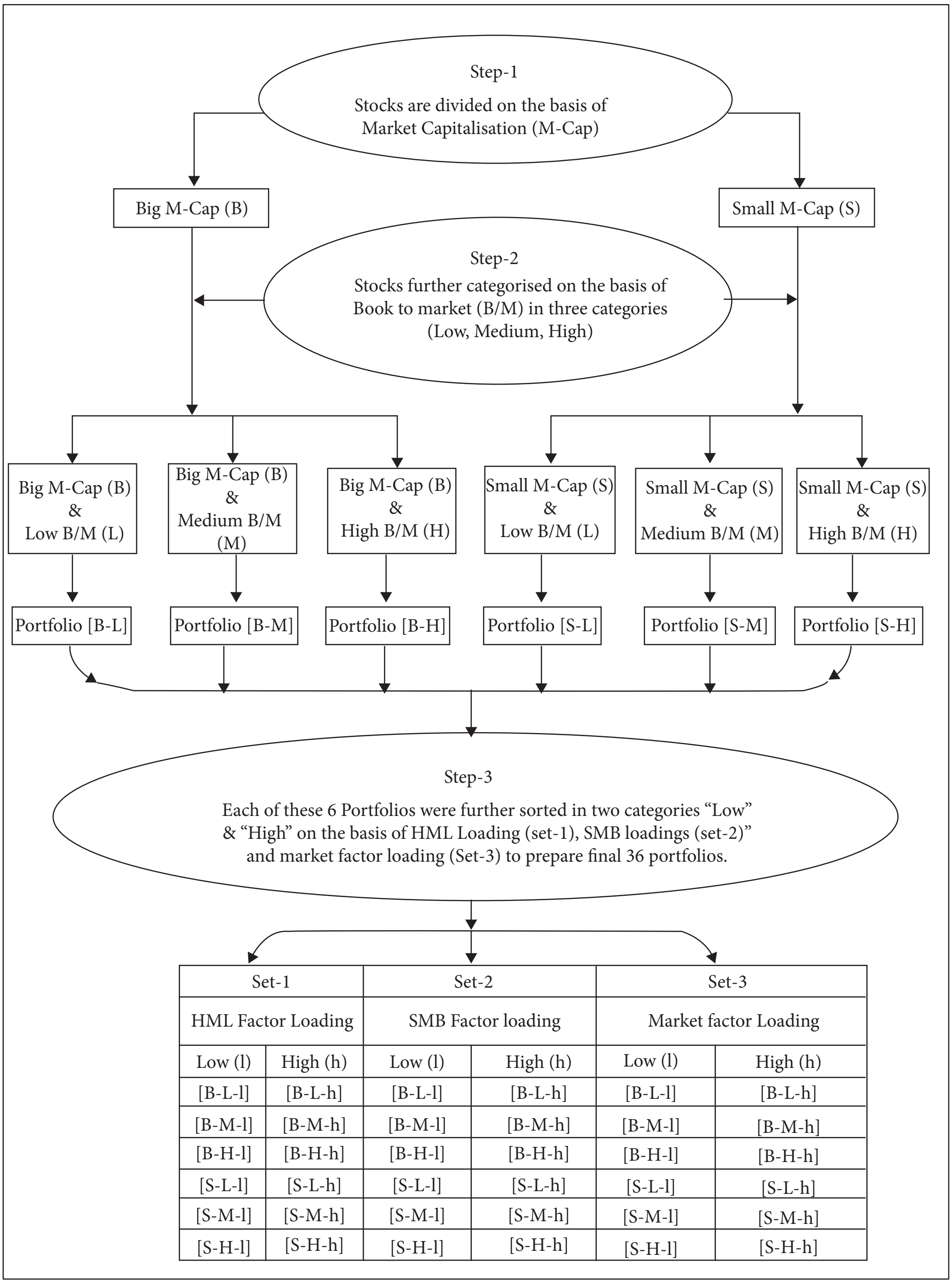

Figure 1: Conceptual Framework (Portfolios construction) for the study (prepared by Authors).

It is evident from the descriptive statistics (Table 2) that the mean monthly return of the HML factor portfolio is 0.859 percent with 2.685 t-statistics, while the Size factor SMB yields a mean monthly premium equalling 1.373 percent and t-statistics of 6.162. The mean excess monthly return of the market portfolio is 0.518 percent with t-statistics of 1.198 (Table 2). Fama and French, via the F&F model (1993), reported a mean return for the market portfolio of about 0.89 percent per month. Inconsistent with Fama and French [5], portfolio returns on HML are positively correlated with both excess market returns and SMB portfolio returns. A negative correlation is reported between SMB and market portfolio returns (Table 2, Panel-B).

Numbers in bold denote significance at the five percent level or better.

4.1. Analysis of Portfolios Sorted on Size, B/M Equity Ratio, and HML Factor Loadings. Daniel and Titman's [6] study is followed for this sorting. Expected future loadings of stocks on the HML factor are estimated. Factor loadings of F&F Model factors are estimated for each stock at the end of June each year, while using 3 years' time-series regressions based on the return per month.

Based on an independent sort on market capitalization (size) and B/M equity, six test portfolios are obtained. Every portfolio is divided into two subportfolios on the basis of their preformation factor (HML/SMB/Market) loadings to get a total of 12 s.

Table 3 reports mean monthly excess returns for the 12 portfolios constructed using size, B/M ratio, and preformation HML factor loadings. The results depict a negative relationship between ex-ante HML factor loadings and average monthly excess returns for portfolios having low B/M equity. Nevertheless, this negative relationship inverts portfolios having medium and high B/M equity. So, evidence of higher mean returns for portfolios with greater factor loading than for portfolios with lower factor loading in four out of six cases is supportive of the F&F model or, as their model of risk hypothesizes that portfolios with greater factor loading yield average return higher than portfolios with lower factor loading.

Table 4 reports the average B/M ratio and size against the median for the test portfolios. Applying value weight, the mean market capitalization, and B/M equity ratio for every portfolio may be computed every year at the construction date:

$$\overline{SZ_t} = \frac{1}{\sum_i ME_{i,t}} \sum_i ME_{i,t}^2,$$
$$\overline{BM_t} = \frac{1}{\sum_i ME_{i,t}} \sum_i ME_{i,t} BM_{i,t}. \quad (3)$$

After that, these can be divided by the median of market capitalization and the B/M ratio of the Indian Market at all the points. Then, these, at all points, are divided by the median values of market capitalization and B/M equity of the Indian market. The numbers displayed in the table below are obtained by averaging both the time series independently.

For every market capitalization and book equity to market equity group, the B/M ratio concerning the median is found to be greater in the case of portfolios with high loadings on the high HML factor compared to low HML loading portfolios. Big portfolios have a negative relation with HML factor loadings.

For each market capitalization and B/M equity class, the highest average excess monthly returns are reported for the portfolio having the highest mean market value concerning median, as is evident from panel A and panel B of Table 3.

Panel 5 shows the regression results based on the F&F model for the 12 portfolios constructed on Size, B/M equity, and preformation HML factor loadings. Numbers given in bold font present a significance level at the five percent or better.

Table 2: Descriptive statistics of factor portfolio (Mimicking Portfolios) returns.

Panel A: Excess return (on monthly basis in percent)					
	Mean	t-value (mean)	Std. Dev.	Skewness	Kurtosis
SMB	1.373	6.162	3.722	0.290	4.102
HML	0.859	2.685	5.348	1.209	6.647
MKT	0.518	1.198	7.227	0.046	3.671
S/L	1.531	2.877	0.0889	0.505	6.317
S/M	1.782	3.215	0.0926	0.363	4.975
S/H	2.602	4.008	0.1084	0.469	4.072
B/L	0.390	0.877	0.0742	0.038	6.366
B/M	0.462	0.925	0.0835	0.194	5.199
B/H	0.944	1.517	0.1039	0.637	4.821
Panel B : Correlations					
	SMB	HML	MKT		
SMB	1.000	0.181	−0.019		
HML	0.181	1.000	0.210		
MKT	−0.019	0.210	1.000		

Table 3: Mean excess monthly returns for the 12 portfolios constructed on size, BM, and HML loadings.

		HML factor loading group	
Size	BM	Low (l)	High (h)
Mean monthly excess returns			
S	*L*	0.012	0.006
B	*L*	0.004	0.001
S	*M*	0.017	0.019
B	*M*	0.006	0.008
S	*H*	0.026	0.030
B	*H*	0.009	0.018

Table 4: Average BM and size of the 12 portfolios constructed on size, B/M equity, and HML loadings.

		HML factor loading portfolios	
Size	BM	Low (l)	High (h)
BM with respect to median			
S	*L*	0.389	0.423
B	*L*	0.306	0.368
S	*M*	0.986	1.057
B	*M*	0.947	1.056
S	*H*	2.754	3.583
B	*H*	2.154	2.509
Size with respect to median			
S	*L*	1.425	1.339
B	*L*	53.391	35.172
S	*M*	0.580	0.580
B	*M*	34.620	29.847
S	*H*	0.302	0.309
B	*H*	13.056	5.941

Table 5 further displays that the ordering pattern of preformation HML slopes is reproduced by the postformation slopes in four out of six cases.

Indeed, for portfolios with high and medium ratios of B/M equity (HS, HB, MS, and MB), postformation slopes can be judged on the basis of preformation slopes. Moreover,

Table 5: Fama–French regression results for the portfolios constructed on size, B/M equity, and HML loadings.

	A	β	s	H	Adj. R^2
S-L-l	−0.002 (−0.711)	**0.994** (19.746)	**0.797** (7.042)	**−0.168** (−2.360)	0.728
S-L-h	**−0.010** (−3.581)	**1.005** (14.081)	**0.784** (7.075)	0.033 (0.487)	0.758
B-L-l	−0.001 (−0.692)	**0.921** (22.341)	**0.194** (2.309)	**−0.169** (−3.366)	0.789
B-L-h	−0.005 (−1.875)	**0.967** (11.425)	0.078 (0.864)	0.057 (1.042)	0.726
S-M-l	−0.002 (−0.488)	**0.914** (17.157)	**0.977** (9.957)	0.086 (1.068)	0.716
S-M-h	−0.005 (−1.391)	**1.019** (15.447)	**1.211** (10.012)	**0.243** (2.532)	0.777
B-M-l	−0.004 (−1.421)	**0.982** (26.659)	**0.198** (2.639)	**0.282** (6.654)	0.809
B-M-h	**−0.007** (−2.320)	**1.117** (14.299)	**0.289** (2.736)	**0.533** (6.767)	0.812
S-H-l	−0.003 (−1.052)	**0.909** (17.246)	**1.422** (11.950)	**0.601** (6.379)	0.824
S-H-h	−0.002 (−0.746)	**1.018** (18.793)	**1.470** (10.820)	**0.768** (12.241)	0.842
B-H-l	**−0.008** (−3.315)	**0.971** (15.607)	**0.488** (4.083)	**0.661** (8.510)	0.810
B-H-h	0.**001** (0.117)	0.944 (8.970)	−0.007 (−0.025)	1.375 (5.650)	0.771

regression intercepts, as anticipated by the F&F model, must be zero. Table 3 reports an absolute value of t-statistics of less than two for nine intercepts. This evidence supports the F&F model.

As predicted by the Titman Model, the alpha values of the portfolios having lower loading on risk factors should be greater than zero, and those of the portfolios having high loading on risk factors should be less than zero, or it suggests a declining pattern in intercepts from low to high factor loadings. However, this study documents that all the intercepts except one are negative. These findings also support the F&F model against the D&T Model.

4.2. Characteristic-Balanced Portfolios Regressions. The returns on the characteristic-balanced portfolio (h–l) of each class of size and B/M equity are calculated by subtracting the returns on low HML factor loading portfolios from that on portfolios having high HML factor loading. Thus, a total of six such characteristic-balanced portfolios are obtained.

Intercepts that are generated by doing a regression of the returns of these portfolios on the returns of the portfolios of the F&F model cannot be distinguished from zero. In contrast, the D&T Model hypothesizes that the time-series regressions of (h–l) should yield negative intercepts. To confirm the validity of the regression model, a GRS test was conducted and GRS Statistics for the model is 0.3160, which is statistically insignificant and confirms the validity of the model.

The mean return of characteristic-balanced portfolios, as conjectured by D&T, must not be distinguishable from zero because small size and big size portfolios have same characteristics. But as per F&F Model, returns generated by these portfolios cannot be negative. The D&T model portfolios carry higher HML factor loading.

Panel A of Table 6 shows the descriptive statistics of the CB portfolios. The first column of Panel A presents the mean returns of the CB portfolios. It reveals that out of six portfolios, only two portfolios have a negative difference in mean monthly return, and both cases are insignificant. This condition supports the F&F model.

Table 6 (panel-B) reveals that the results which are consistent with the Fama–French Model. The table also shows that the regressions of portfolio returns of CB portfolios against the returns of all three factors generated intercepts that have t-statistics less than two in five out of six instances.

It can be summarized that the evidence coming from Table 3 and panel A of Table 6 points out that the D&T model cannot be accepted, and the evidence from Table 5 and Panel B of Table 6 does not discard the F&F model. As a whole, the present analysis shows the F&F model is superior and accepts it over the D&T.

4.3. Analysis of Portfolios Sorted on Size, B/M Ratio, and SMB Factor Loadings. The procedure, same as the HML factor loadings, was used to analyze the performance of SMB factor loadings. The results display a positive relationship between average excess monthly returns and ex-ante SMB loadings for all the portfolios. Thus, the F&F model is supported as it predicts that higher average returns are observed in the case of portfolios with greater factor loading than in portfolios with lower factor loading.

The analysis further shows that the average B/M ratio and size with respect to the median for the test portfolios, Applying value weighting, the mean market capitalization, and B/M equity are computed for each portfolio every year at the construction date: Then, these at all points are divided by the median values of market capitalization and B/M equity of Indian stock market.

For the low B/M equity class, the average B/M equity against the median is observed to be higher for low SMB loading portfolios in comparison to the high SMB factor loading portfolios. This pattern is reversed for the group with medium B/M equity.

For every group of size and B/M equity, the average market capitalization concerning the median is recorded to be higher for portfolios having lower SMB factor loadings than the higher SMB factor loading portfolios.

It is also found that the results produced by regressions of each of the 12 test portfolios on the three risk factors. The market betas for all the portfolios are either one or close to one. HML slopes are positively related to B/M equity as with the increase in B/M equity, HML slopes also increase, and values that were negative for a group having lower B/M equity become positive for a group having higher B/M equity.

Table 6: Mean monthly excess returns and regression results for the characteristic-balanced portfolios sorted on size, B/M, and HML factor loadings.

Panel A: Mean excess monthly returns					
	Mean	Std. Dev.		t-statistic	
SL (h_h–l_h)	−0.006	0.049		−1.795	
BL (h_h–l_h)	−0.003	0.047		−1.016	
SM (h_h–l_h)	0.002	0.054		0.631	
BM (h_h–l_h)	0.002	0.048		0.680	
SH (h_h–l_h)	0.004	0.066		0.942	
BH (h_h–l_h)	0.009	0.073		1.864	
Avg. (h_h–l_h)	0.001	0.030		0.707	
Panel B: Fama–French regression results					
	α	β	s	h	Adj. R^2
SL (h–l)	**−0.0075** (−2.3784)	0.0112 (0.1742)	−0.0137 (−0.0971)	**0.2011** (3.0129)	0.0402
BL (h–l)	−0.0039 (−1.1884)	0.0458 (0.5805)	−0.1160 (−0.9779)	**0.2265** (3.6028)	0.0729
SM (h–l)	−0.0030 (−0.7632)	0.1055 (1.6393)	**0.2339** (2.1521)	**0.1575** (2.4250)	0.0754
BM (h–l)	−0.0021 (−0.7256)	0.1346 (1.6738)	0.0902 (1.0499)	**0.2507** (3.5982)	0.1488
SH (h–l)	0.0013 (0.3434)	**0.1091** (2.8170)	0.0478 (0.2360)	0.1675 (1.5278)	0.0309
BH (h–l)	0.0089 (1.6530)	−0.0261 (−0.2688)	−0.4949 (−1.5028)	**0.7140** (2.4471)	0.2947
Avg (h–l)	−0.0010 (−0.6910)	0.0633 (1.4559)	−0.0421 (−0.6354)	**0.2862** (6.7566)	0.3173

Numbers in bold denote significance at the 5 percent level or better.

In the same way, SMB slopes are also related to size, but they are negatively related. Every B/M-HML loading class witnesses a reduction in SMB slopes on moving from smaller to bigger capitalization portfolios. And the ordering of the preformation SMB slopes is reproduced by the post-formation slopes in all six cases. Indeed, preformation slopes seem educative about their postformation slopes: portfolios that carry High factor loading comparatively observe higher SMB loading than the portfolios that carry low factor loading in comparison to the low factor loading portfolios observe higher SMB loading.

Moreover, regression intercepts, as anticipated by the factor model, should be zero. The table reports that t-statistics has an absolute value of less than two in ten instances of intercepts. This evidence supports the F&F model.

4.4. Characteristic-Balanced Portfolios Regressions. As in the previous section, a new set of six characteristics-balanced portfolios is formed using preformation HML factor loadings. The characteristic-balanced portfolio returns (h–l) of every size and B/M ratio group are calculated by subtracting the returns on high SMB factor loading portfolios from that on portfolios having low SMB factor loading. Thus, a total of six such characteristic-balanced portfolios are obtained.

All means except one are indistinguishable from zero. Evidence of positive mean returns in five out of six instances does not let us reject the factor model. Thus, no conclusive result is obtained based on mean returns.

Panel B of Table 7 shows the results which seem supportive of the Fama–French model. The table reports that the time-series regressions of portfolio returns of characteristic-balanced portfolios on the three-factor returns generate intercepts that have t-statistics below two in all six instances. Also, there is no significant negative intercept in any of the characteristic-balanced portfolios.

To conclude, the evidence in Panel A of Tables 6 and 7 favors the Fama–French model, and the evidence in Panels C of Table 5 and panel B of 6 also supports the Fama–French model.

4.5. Analysis of Portfolios Sorted on Size, B/M Equity, and Market Factor Loadings. Panel A of Table 8 shows the mean excess monthly returns for the 12 portfolios constructed by sorting the stocks based on size, B/M equity ratio, and market factor slopes. A positive relationship is found between average excess monthly returns and ex-ante market factor loadings for four portfolios out of six. Thus, the F&F model is supported as it predicts that high factor loading portfolios observe higher average returns than that of low factor loading portfolios.

Panel B reports the average B/M ratio to market equity and size against the median for the test portfolios. Applying value weighting, the mean market capitalization and B/M equity for each portfolio are calculated every year at the construction date.

Then, all of these points are divided by the median values of market capitalization and B/M equity of the Indian market. The numbers displayed in the table below are obtained by averaging both the time series independently.

Table 7: Mean excess monthly returns and Fama–French regression results for the characteristic-balanced portfolios sorted on size, B/Mand SMB factor loadings.

Panel A: Mean excess monthly returns			
	Mean	Std. Dev.	t-statistic
SL (h–l)	0.005	0.048	1.720
BL (h–l)	0.002	0.043	0.543
SM (h–l)	0.006	0.049	1.788
BM (h–l)	0.002	0.042	0.815
SH (h–l)	0.011	0.068	2.437
BH (h–l)	−0.001	0.073	−0.174
Avg (h–l)	0.004	0.029	2.156

Panel B: FF regression results					
	A	β	s	h	Adj. R^2
SL (h–l)	0.002 (0.649)	0.214 (4.030)	0.268 (2.600)	−0.147 (−1.797)	0.118
BL (h–l)	0.000 (0.004)	0.055 (0.952)	0.187 (2.136)	**−0.142** (−2.120)	0.036
SM (h–l)	0.002 (0.541)	0.054 (0.990)	0.284 (2.864)	−0.032 (−0.665)	0.035
BM (h–l)	−0.001 (−0.279)	0.105 (2.253)	0.271 (2.716)	−0.118 (−1.766)	0.072
SH (h–l)	0.003 (0.887)	0.117 (1.929)	0.573 (2.796)	−0.085 (−0.943)	0.089
BH (h–l)	−0.007 (−1.325)	0.127 (1.435)	0.859 (2.648)	**−0.629** (−2.046)	0.314
Avg (hs–ls)	0.000 −0.142	0.112 3.951	0.407 6.610	−0.192 −4.936	0.332

Numbers in bold denote significance at the 5 percent level or better.

Table 8: Mean excess monthly returns and F&F regression for the CB portfolios sorted on size, B/M, and market factor loadings.

Panel A: Mean excess monthly returns			
	Mean	Std. Dev.	t-statistic
SL (h–l)	0.003	0.052	0.976
BL (h–l)	0.001	0.054	0.169
SM (h–l)	0.003	0.050	0.950
BM (h–l)	−0.001	0.044	−0.357
SH (h–l)	0.006	0.066	1.400
BH (h–l)	−0.001	0.073	−0.173
Avg. (h–l)	0.002	0.031	0.930

Panel B: FF regression results					
	α	β	s	h	Adj. R^2
SL (h–l)	0.002 (0.620)	0.287 (4.835)	0.084 (0.765)	−0.131 (−2.067)	0.140
BL (h–l)	−0.001 (−0.402)	0.356 (3.924)	0.102 (0.958)	−0.144 (−2.332)	0.201
SM (h–l)	−0.002 (−0.757)	0.181 (3.248)	0.307 (2.405)	0.020 (0.354)	0.105
BM (h–l)	0.000 (0.135)	0.219 (4.541)	−0.106 (−1.092)	−0.105 (−1.495)	0.127
SH (h–l)	−0.001 (−0.403)	0.224 (4.422)	0.378 (1.914)	0.113 (1.360)	0.113
BH (h–l)	0.002 (0.231)	0.019 (0.173)	−0.458 (−1.204)	0.402 (1.134)	0.114
Avg (h–l)	0.000 (−0.063)	0.214 (4.982)	0.051 (0.578)	0.026 (0.400)	0.254

For the low B/M equity class, the average B/M equity against the median is observed to be higher for low Market factor loading portfolios in comparison to the high Market factor loading portfolios. This pattern is reversed for the group with medium B/M equity while no such pattern is observed in the case of the high B/M class.

For each group of size and B/M equity, the average market capitalization concerning the median is recorded to be higher for portfolios having low market factor loadings than the high market factor loading portfolios. This pattern is reversed for the group with medium B/M equity, while no such pattern is observed in the case of the high B/M equity class.

Panel C reports the results produced by regressions of each of the 12 test portfolios on the three risk factors. HML slopes are positively related to B/M equity as with the increase in B/M equity, HML slopes also increase and values that were negative for the group having lower B/M equity become positive for the group having higher B/M equity. Similarly, SMB slopes are related to size, but these are negatively related.

Panel C also displays that the ordering of the preformation SMB slopes is reproduced by the postformation slopes in all six cases. Indeed, preformation slopes are educative about postformation slopes: Higher Market loading (β) is observed for higher factor loading portfolios than that for lower factor loading portfolios.

Moreover, regression intercepts, as anticipated by the Fama–French model, must be zero. The table reports that t-statistics has a value of less than two in eleven instances of intercepts. This evidence also supports the Fama–French model.

4.6. Characteristic-Balanced Portfolios Regressions. As in the previous section, a new set of six characteristics-balanced portfolios is formed using preformation market factor loadings. The characteristic-balanced portfolio returns (h–l) of each size and B/M equity ratio group are calculated by reducing the portfolio returns on.

Low market factor loading portfolios from the portfolio are having high market factor loading. Thus, a total of six such characteristic-balanced portfolios are obtained.

Mean monthly returns for all (h–l) portfolios are indistinguishable from zero. The evidence of four out of six means monthly returns being positive supports the factor model. Thus, on the basis of mean returns of the characteristics-balanced portfolios, no satisfactory conclusion can be derived about the two models.

Panel B of Table 8 shows the results generated from the Fama–French regressions of CB portfolio returns. The table reports all the intercept values statistically indistinguishable from zero. Thus, the factor model is accepted. However, three intercepts are negative. These findings favor the F&F over the Characteristics Model and hence refute the findings of the Characteristics Model (1997).

5. Conclusion

This study examines the returns on the Indian stocks on the basis of the period from July 1993 to June 2018. The value effect in average stock returns, measured by *HML* Portfolios, is 0.859% with t statistics of 2.685 and the market effect, measured by *MKT* Portfolios, is only 0.518% with a t statistics of 1.198, while the size effect, measured by *SMB* Portfolios, is robust. It is 1.73% with t statistics of 6.162 [7, 8, 20, 30].

Fama and French [5] contend that stock returns can be described by three factors, namely, market, size, and book-to-market equity. However, the model lacks any well-built academic justification as to why size and book-to-market describe the cross-sectional differences in predicted returns of stocks. Fama and French [5] argue that higher return earned by firms with small size and a high book-to-market ratio is a reward for distress risk. This risk-based explanation, on account of a paucity of theoretical justification, has faced criticism from many scholars. The characteristics model propounded by Daniel and Titman [6] is the most severe of all the attacks that maintain that cross-sectional differences in predicted returns are described not by priced loadings on risk factors but by the characteristics of firms similar in size and book-to-market equity. The study examined whether expected returns generated by the Fama–French model (1993) are determined by loadings on risk factors or by characteristics of firms.

For testing these models, the authors used the methodology of Daniel and Titman to form characteristic-balanced portfolios. These portfolios are long and short assets with equal characteristics. D&T model predicted zero average rates of return on these portfolios.

However, the F&F model suggested the positive returns on these portfolios because the characteristic-balanced portfolios' loading on the HML factor (or SMB or β loadings) was very high.

The F&F risk model predicted that the intercepts of time-series regressions of the returns of these characteristic-balanced portfolios on the Fama and French factor portfolios are indistinguishable from zero.

In contrast, the hypothesis of the characteristic model says that these intercepts should be negative. But the results of this study revealed that, except in a few cases, all the intercepts have t-statistics below two. And the results of this study favor the F&F model over the D&T model. These results are consistent for the F&F model and not consistent for the D&T model.

It is found that most of the test portfolios displayed high returns for high loadings. Moreover, most of the intercepts from Fama–French regressions are not significant. And for the characteristic-based portfolios (D&T model), all the intercept terms are nonsignificant.

To conclude, the methodology proposed by Daniel and Titman distinguishes the factor model and does not allow one to make clear conclusions about the Indian context. Results obtained by the F&F model, despite its shortcomings, are more conclusive than the results obtained by D&T Model. These shortcomings are not those predicted by the characteristic model.

To show that covariances and characteristics are not the same and can be differentiated for the Indian stock market, this evidence favors the F&F model over the D&T Model. In a pragmatic way, we can say that the F&F model is a good tool for describing returns. It can be useful for many fields in finance, such as portfolio analysis, performance evaluation, or corporate finance. However, the debate regarding its theoretical legitimacy remains open [47, 48].

6. Implication and the Future Scope of the Study

The present work is useful for academicians as well as professionals in the different fields of finance like portfolio analysis, corporate finance, shares trading, etc. It provides good insights/trends and performance analysis of Indian Stocks. The study opens up the ways for the other researchers to use these models (1) to analyze the performance of the different portfolios, (2) corporate financing, (3) performance evaluation and comparison, (4) addition of other factors in the F&F model, and (5) review and comparative study of other models.

Researchers are especially expected to conduct a comparative study of 5-factor model of Fama–French with Daniel and Titman's characteristics model. Researchers may also add illiquidity as a risk factor and analyze the results.

Data Availability

The quantitative data used to support the findings of this study can be obtained from the corresponding author upon request.

Conflicts of Interest

There are no conflicts of interest among the authors of this manuscript.

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