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DECODING RISK PRICING IN INDIA: AN EMPIRICAL INVESTIGATION OF FACTOR MODEL PERFORMANCE

Keywords: Fama–French five factor model, profitability, investment, COVID-19.

J E L Classification: G4, G11, G12.

Abstract: The current study focuses on explaining the average excess returns on portfolios constructed using fundamental factors. This is a maiden attempt to elucidate the efficacy of Fama & French (2015) five factor model for the sample period March 31, 2016 to March 31, 2023, thus, including also the COVID-19 crisis (2020–2023) period. The study endeavors to examine whether the efficacy of this model still holds true during pandemic. The results suggest that Fama and French (2015) five factor model has a better explanatory power than Fama and French (1993) three factor model in India, as 75% intercepts of FF5F are statistically insignificant in contrast to 50% of FF3F. However, a novel observation is found when profitability factor, in addition to investment factor, becomes redundant. Consequently, when comparative analysis is done between

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stable and pandemic period, the market and size factor lose their relevance during the pandemic period. The results provide valuable insights for the investors, policymakers, and portfolio managers, which shall aid them in understanding stock determinants effectively.

■■■ INTRODUCTION

Capital Asset Pricing Model has been the pioneer model, which considers the relationship between expected return of a security and its associated risk (Sharpe, 1964; Lintner, 1965; Black, Jensen & Scholes, 1972). However, it has been criticized on grounds of unexplained variation in average stock returns due to the presence of anomalies (Harshita, Singh & Yadav, 2015). The seminal papers reported these anomalies, which have consistently risen (Shanbhag & Quddus, 2025), refuting the perfect model of investor rationality.

In this light, Fama and French (1992) evaluated combined role of anomalies, namely – market beta, firm size, book to market equity, earnings to price ratio and leverage, to demonstrate their explanatory power in cross section of average stock returns. This model was reformed in Fama and French (1993), which stated that portfolio's expected return in excess of risk-free rate is determined by return sensitivity of three factors, namely – excess market return, size and book to market equity. Hence, Fama–French three factor model (FF3F) has established its importance as the benchmark model in the asset pricing literature.

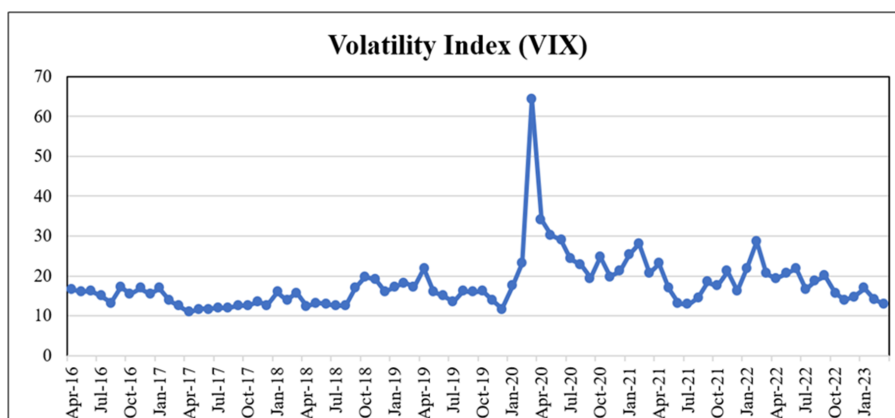
Subsequently, Fama and French (2015) discovered that variation relating to profitability and investment was left unexplained in FF3F. Therefore, they constructed a five-factor model, by incorporating these factors in FF3F. The results of the said model proposed that Fama–French five-factor model (FF5F) outperformed FF3F in the US.

However, experts are still arguing on what causes price fluctuations in these fundamental risk factors (Sharma, Srikanth & Suresha, 2022). Extensive literature is available regarding the efficiency of FF5F in developed economies but is scarce in relation to emerging economies, especially in India. Alam (2025) compared various asset pricing models from October 1995 to September 2022 and found that FF5F has demonstrated superior performance over others. Singh, Singh and Prakash (2023) evaluated the explanatory potential of FF5F in comparison to other competing models and suggested its outperformance. Nonetheless, investment factor was found redundant for the sample

period 1999–2020. Khudoykulov (2020) concluded that FF5F had done a plausible job in terms of description of stock returns for period January 2009 to November 2018. Balakrishnan, Maiti and Panda (2018) investigated the validity of FF5F and found that this model explains average returns better than the benchmark model.

However, none of the studies has taken into account the coronavirus disease of 2019 (COVID-19) crisis (2020–2023). Also, India has recorded its first ever Gross Domestic Product (GDP) contraction by 7.3% in the last 40 years owing to COVID-19. This crisis has significantly impacted financial markets globally (Joshi, 2023), which brings with it hitherto unheard-of difficulties (Patil & Jain, 2024). As a result, Indian stock market witnessed significant volatility (Dharani, Hassan, Huda & Abedin, 2023). Figure 1 elucidates the extraordinary surge in Volatility Index (VIX) in India during the first quarter of 2020. Hence, it becomes imperative to study the response of asset pricing models towards heightened volatility in India.

Figure 1. Volatility Index (VIX) in India



Note: based on data extracted from Bloomberg database on VIX index in India.

Source: prepared by the authors.

The study shall first compare the FF5F with the benchmark model (FF3F) to see whether the variations in stock returns, which remain unexplained by size and book to market equity, would be explained by newly added factors – profit-

ability and investment. Second, the current study shall check the redundancy of factors as suggested by Fama and French (2015).

MATERIALS AND METHODS

The study comprises monthly data of non-financial firms of NIFTY 500 companies for sample period March 31, 2016 to March 31, 2023. The rationale for selected time period is extraordinary surge in trading volume at National Stock Exchange of India (NSE) since 2016 (Naina & Gupta, 2022). NIFTY 500 serves as a market proxy, as it comprises 93% of free float market capitalization of NSE-listed equities (as on September 29, 2023). The proxy for risk-free rate is 91-day treasury bill rate, which is obtained from the website of Reserve Bank of India. Databases such as Bloomberg, Ace Equity, and NSE's website are referred for extracting financial data of companies.

Construction of Portfolios

The portfolio construction is in accordance with Fama and French (1993, 2015). The variables are defined in table 1. The study sort stocks into two Size bisects – Small (S) and Big (B), two Book to Market Equity bisects – Low (L) and High (H), two Profitability bisects – Weak (W) and Robust (R), and two Investment bisects – Conservative (C) and Aggressive (A). 4 bivariate sorted portfolios are formed (2×2), in SZ/BME sorts are constructed for FF3F, while 16 multivariate sorted portfolios are formed ($2 \times 2 \times 2 \times 2$), in SZ/BME/OP/INV sorts are constructed for FF5F. Each portfolio is built on March 31 every year with a total of 84 observations. The description of above-mentioned variables is exhibited in Panel A of table 1. Monthly excess returns are calculated for each equally weighted portfolio.

Table 1. Estimation of Variables

Panel A: Variables used for portfolio formation (Fama and French, 2015)		
Variable Name	Abbreviation	Measurement
Size	SZ	Market capitalization as on March 31 every year
Book to Market Equity	BME	Inverse of Price to Book ratio as on March 31 every year
Profitability	OP	Ratio of profit after interest to book value as on March 31 every year
Investment	INV	Growth of total assets for the financial year ending in $t - 1$ divided by the total assets at the financial year end $t - 2$
Panel B: Fundamental factors in FF3F		
Variable Name	Abbreviation	Measurement
Excess Market Return	MKT_3	Excess market return over risk free rate
Small Minus Big	SMB_3	Difference between average returns of small size and big size stock portfolios
High Minus Low	HML_3	Difference between average returns of high book to market equity and low book to market equity stock portfolios
Panel C: Fundamental factors in FF5F		
Variable Name	Abbreviation	Measurement
Excess Market Return	MKT_5	Market return over risk free rate
Small Minus Big	SMB_5	Difference between average returns of small size and big size stock portfolios
High Minus Low	HML_5	Difference between average returns of high book to market equity and low book to market equity stock portfolios
Robust Minus Weak	RMW	Difference between average returns of robust profitability and weak profitability stock portfolios
Conservative Minus Investment	CMA	Difference between average returns of conservative investment and aggressive investment stock portfolios

Source: constructed by the authors, based on Fama & French (2015).

Construction of Fundamental Factors

The fundamental factors are constructed in accordance with Fama and French (1993, 2015). Panel B and Panel C of table 1 provide estimation of fundamental factors of FF3F and FF5F, respectively. Market return is calculated as:

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

Where, P_t = Closing price of market return proxy (NIFTY 500) at time t .

The analysis begins with estimating both FF3F and FF5F. FF3F is expressed as follows:

$$R_{pt} - r_{ft} = \alpha + \beta_{MKT3} (MKT_{3t}) + \beta_{SMB3} (SMB_{3t}) + \beta_{HML3} (HML_{3t}) + \varepsilon_{pt} \quad (2)$$

where, $R_{pt} - r_{ft}$ is the portfolio excess return; β represents the return sensitivities of three factors of the model; MKT_{3t} represents the excess market return; SMB_{3t} and HML_{3t} are factor-mimicking portfolios for size and book to market equity respectively; ε_{pt} represents the error term.

Subsequently, FF5F is expressed as follows:

$$R_{pt} - r_{ft} = \alpha + \beta_{MKT5} (MKT_{5t}) + \beta_{SMB5} (SMB_{5t}) + \beta_{HML5} (HML_{5t}) + \beta_{RMW} (RMW_t) + \beta_{CMA} (CMA_t) + \varepsilon_{pt} \quad (3)$$

where, $R_{pt} - r_{ft}$ is the portfolio excess return; β represents the return sensitivities of five factors of the model; MKT_{5t} represents the excess market return; SMB_{5t} , HML_{5t} , RMW_t and CMA_t are factor-mimicking portfolios for size, book to market equity, profitability and investment, respectively; ε_{pt} represents the error term.

The intercepts of these portfolios should be insignificantly distinguishable from zero, if these factors generate premium as a compensation of risk. On the contrary, presence of significant intercepts in the model imply that the model does not fully explain average returns.

Factor Spanning Tests

Factor spanning tests are performed to assess the redundancy of factors. Each factor is regressed on remaining factors of the model.

RESULTS AND DISCUSSION

Descriptive Statistics

Panel A of table 2 provides descriptive statistics of fundamental factors of FF3F. Mean return of SMB_3 factor is highest with 0.16%, while others exhibit negative mean returns. However, standard deviation of MKT_3 factor is highest (5.52%), which indicates volatility in the market. Panel B of table 2 reflects return patterns of 4 portfolios. Small stock portfolios (SL: -2.58% and SH: -3.81%) outperform big stock portfolios (BL: -2.65% and BH: -4.07%). This suggests that as size increases, mean returns diminish. Hence, strong size effect is exhibited in the results of FF3F. While, mean returns are high for growth stocks (SL: -2.58% and BL: -2.65%) and low for value stocks (SH: -3.81% and BH: -4.07%), which imply that growth stocks outperformed value stocks.

Panel C of table 2 exhibits descriptive statistics of fundamental factors of FF5F. Mean returns of CMA factor are highest (0.71%), followed by RMW factor and SMB_5 factor.

Panel D of table 2 provides descriptive statistics of 16 portfolios. Mean returns of small stock portfolios (ranging from -2.12% to -4.66%) are more than those of big stock portfolios (ranging from -2.31% to -4.57%), thereby indicating size effect. Similarly, mean returns of growth stocks (ranging from -2.12% to -3.92%) are higher than mean returns of value stocks (ranging from -2.92% to -4.66%). Furthermore, portfolios with robust profitability (ranging from -2.12% to -4.29%) exhibit higher returns than portfolios with weak profitability (ranging from -2.20% to -4.66%), hence validating the profitability effect. Meanwhile, portfolios using conservative investment strategies (ranging from -2.12% to -3.71%) outperform the portfolios using aggressive investment strategies (ranging from -2.19% to -4.66%), hence exhibiting investment effect.

The value of kurtosis for all factors and portfolios is greater than three (except in CMA), indicating that data is sharply peaked.

Table 2. Descriptive Statistics

Panel A: Descriptive Statistics of FF3F				
Factors	Mean	Standard Deviation	Skewness	Kurtosis
MKT ₃	-0.042	0.055	-0.644	6.844
SMB ₃	0.0016	0.035	0.785	8.085
HML ₃	-0.013	0.018	-0.433	3.049
Panel B: Descriptive Statistics of 4 portfolios				
Portfolios	Mean	Standard Deviation	Skewness	Kurtosis
SL	-0.025	0.082	-0.450	6.987
SH	-0.038	0.084	-0.578	6.140
BL	-0.026	0.059	-0.379	4.202
BH	-0.040	0.061	-0.397	6.014
Panel C: Descriptive Statistics of FF5F				
Factors	Mean	Standard Deviation	Skewness	Kurtosis
MKT ₅	-0.042	0.055	-0.644	6.844
SMB ₅	0.0015	0.035	0.718	7.876
HML ₅	-0.013	0.018	-0.435	3.059
RMW	0.005	0.019	0.464	3.223
CMA	0.0071	0.016	0.308	2.768
Panel D: Descriptive Statistics of 16 portfolios				
Portfolios	Mean	Standard Deviation	Skewness	Kurtosis
SLWC	-0.022	0.098	0.614	7.787
SLWA	-0.03	0.085	-1.851	11.59
SLRC	-0.021	0.078	0.050	5.168
SLRA	-0.021	0.084	-0.030	6.843
SHWC	-0.038	0.092	-0.040	5.095
SHWA	-0.046	0.097	-0.939	6.518
SHRC	-0.029	0.082	0.366	5.735
SHRA	-0.037	0.081	-0.838	7.353
BLWC	-0.022	0.069	0.477	3.755

Table 2. Descriptive...

Panel D: Descriptive Statistics of 16 portfolios				
Portfolios	Mean	Standard Deviation	Skewness	Kurtosis
BLWA	-0.034	0.062	-0.819	4.979
BLRC	-0.026	0.055	-0.421	4.618
BLRA	-0.023	0.065	0.032	4.350
BHWC	-0.037	0.075	-0.421	6.112
BHWA	-0.045	0.066	-0.478	6.133
BHRC	-0.037	0.057	-0.340	4.030
BHRA	-0.042	0.055	0.022	5.990

Note : refer to Panel B and C of table 1 for description of fundamental factors; refer to Panel A and Panel B of Appendix table 1 for description of portfolio names.

Source : based on authors' calculation.

Multiple Regression

Panel A of table 3 presents results of the multivariate regression of FF3F. The coefficients of SMB_3 factor are positive, which indicates that small stocks tend to outperform big stocks in India. In case of HML_3 , positive coefficients indicate that value stocks outperform growth stocks, while negative coefficients indicate outperformance of growth stocks over value stocks. The intercepts of 2 out of 4 portfolios (50%) are statistically insignificant in case of SH and BL, which indicates there are no missing factors in this case; hence, the model is a good fit. Coefficient of MKT_3 is significant at 1% level of significance (LOS) in all 4 portfolios, thereby exhibiting that the portfolio excess returns are explained by the market beta. Size effect is witnessed in 3 portfolios where the beta coefficients of SMB are significant (SL, SH, and BH). Similar pattern is observed for value effect where beta coefficients of HML are significant (SL, BL, and BH). Although values of adjusted R^2 coefficients are high, the model seems to be incomplete, as intercept for other two portfolios (SL and BH) are significant. Hence, this model fails to capture the variation in returns, thus indicating scope for including more additional factors.

Furthermore, Panel B of table 3 presents multivariate regression results of FF5F. MKT exhibits similar tendency as in FF3F. Likewise, coefficients of SMB_5

and HML_5 display a pattern analogous to results of FF3F. Size effect and value effect is significantly witnessed in 9 and 10 portfolios, respectively.

Positive RMW coefficients indicate that companies in those portfolios have high profitability. These stocks perform well during slow growth period. Meanwhile, negative coefficients indicate that companies have weak profitability. In addition, profitability effect is observed in 13 portfolios with significant RMW coefficients. Furthermore, positive CMA coefficients imply low asset growth and companies prefer to have conservative investment strategies, while negative CMA coefficients imply high asset growth and companies following aggressive investment strategies. Besides, investment effect is witnessed in 11 portfolios with significant CMA coefficients. Hence, all these factors collectively contribute to better explanation of FF5F.

The intercepts of 12 out of 16 portfolios (75%) are statistically insignificant (except in the case of SLRA, SHWC, BLRA, and BHWC portfolios), suggesting that there are no missing factors in the model; hence, the model is a good fit.

The Adjusted R^2 values are exceptionally high and consistent with Harshita et al. (2015), Balakrishnan et al. (2018), Khudoykulov (2020), and Singh et al. (2023), which indicates that FF5F is able to explain average returns on these portfolios. Proportion of portfolios having insignificant intercepts is higher in FF5F; therefore, making it robust, the former model is considered more comprehensive than FF3F.

Table 3. Multivariate Regression Results

Panel A: FF3F							
Portfolio Groups	Intercept	Beta Coefficients			Adjusted R ²		
		MKT ₃	SMB ₃	HML ₃			
SL	0.005***	1*	1.145*	-0.712*	0.95		
SH	0.004	0.994*	1.099*	0.128	0.94		
BL	0.004	0.995*	0.099	-0.872*	0.89		
BH	0.005***	1*	0.145**	0.288**	0.91		
Panel B: FF5F							
Portfolio Groups	Intercept	Beta Coefficients					Adjusted R ²
		MKT ₅	SMB ₅	HML ₅	RMW	CMA	
SLWC	-0.001	0.891*	1.416*	-0.793*	-0.802*	1.256*	0.90
SLWA	0.002	0.948*	0.951*	-0.423**	-0.554*	-0.620*	0.87
SLRC	0.005	1.103*	0.854*	-0.751*	0.456*	0.852*	0.88
SLRA	0.009**	1.104*	1.177*	-0.834*	0.554*	-0.003	0.91
SHWC	0.008***	1.159*	0.871*	0.172	-0.425*	0.813*	0.92
SHWA	0.003	1.037*	1.116*	0.101	-0.764*	-0.201	0.91
SHRC	-0.004	0.924*	1.265*	0.066	1.182*	0.787*	0.79
SHRA	0.005	0.933*	1.047*	0.159	0.000	-0.35***	0.89
BLWC	0.000	1.010*	0.013	-1.299*	-0.633*	0.948*	0.82
BLWA	-0.001	0.939*	0.126	-0.784*	-0.212	-0.395**	0.79
BLRC	0.002	0.916*	0.093	-0.494*	0.088	0.432**	0.78
BLRA	0.010**	1.188*	0.070	-0.924*	0.750*	0.060	0.83
BHWC	0.014*	1.141*	0.063	0.513*	-0.485*	0.832*	0.90
BHWA	0.002	0.975*	0.145***	0.211	-0.478*	-0.102	0.88
BHRC	0.001	0.955*	0.121	0.283**	0.266***	0.6111*	0.84
BHRA	-0.002	0.975*	0.068	0.192	0.351*	0.1443	0.86

Note: * significant values at 1% LOS, ** significant values at 5% LOS, *** significant values at 10% LOS.

Refer to Panel B and C of table 1 for description of fundamental factors. Refer to Panel A and Panel B of Appendix table 1 for description of portfolio names.

Source: based on authors' calculation.

Factor Spanning Tests

Furthermore, Fama and French (2015) found that value factor (HML) was redundant in their study. Panel A and Panel B of table 4 show the results of factor spanning test. The results suggest that no factor is redundant in FF3F, as the intercepts of all factors are significant at 1% LOS. Meanwhile, RMW and CMA are found to be redundant with insignificant intercepts in FF5F. The redundancy of CMA factor is consistent with Singh et al. (2023) for India. However, contrary to findings of Singh et al. (2023), RMW was redundant. This novel finding may exist on account of increased retail participation in India. The stocks may generate high returns in bullish sentiment and vice versa, irrespective of any profitability or investment parameters. Such redundancy could also indicate the necessity to augment behavioral aspects into the study, which shall drive decision-making of retail investors. Hence, results for the Indian stock market changed as the sample size increased.

Table 4. Factor Spanning Test

Panel A: FF3F							
	Intercept	MKT ₃	SMB ₃	HML ₃	Adjusted R ²		
MKT ₃	-0.041*	—	0.726*	0.149	0.21		
SMB ₃	0.018*	0.297*	—	0.320***	0.24		
HML ₃	-0.013*	0.022	0.114***	—	0.04		
Panel B: FF5F							
	Intercept	MKT ₅	SMB ₅	HML ₅	RMW	CMA	Adjusted R ²
MKT ₅	-0.031*	—	0.551*	0.122	-1.084*	-0.632**	0.36
SMB ₅	0.016*	0.268*	—	0.318***	-0.204	0.322	0.26
HML ₅	-0.012*	0.022	0.119***	—	0.011	0.009	0.02
RMW	-0.000	-0.167*	-0.065	0.009	—	-0.130	0.24
CMA	0.004	-0.087**	0.091	0.006	-0.116	—	0.01

Note: * significant values at 1% LOS, ** significant values at 5% LOS, *** significant values at 10% LOS.

Refer to Panel B and C of Table 1 for description of fundamental factors.

Source: based on authors' calculation.

On the contrary, value factor still holds a significant place in the Indian stock market for sample period March 31, 2016 to March 31, 2023. This is inconsistent with findings of Fama and French (2015) in the US, but is consistent with Singh et al. (2023) in India.

Comparative Analysis of Factor Redundancy in Stable and Pandemic Periods

Furthermore, a comparative sub-period analysis is conducted by segregating the full sample period sub-divided into time frames – Stable Period (April 2016 to February 2020) and Pandemic Period (March 2020 to March 2023). The rationale for this structural break is the announcement by World Health Organization (WHO) regarding COVID-19 as a global pandemic (Karavias, Narayan & Westerlund, 2023), followed by strict lockdown across the globe. The comparative analysis shall ensure the consistency of results by observing whether the results hold true across the whole period or get influenced by volatility in markets during crisis situations.

Table 5 exhibits the results of Factor Spanning tests by checking the redundancy of factors of FF5F across sub-periods. The results reveal notable variations across different time frames, thereby reinforcing the presence of regime-dependent dynamics in asset pricing.

While the MKT and SMB factors retained their explanatory power during the full period analysis as exhibited by table 4, they became redundant (insignificant intercepts) during the pandemic period. Thus, the results are consistent with the literature where the fundamental risk factors become insignificant during crisis periods (Horváth & Wang, 2021). Stock price movements during such periods are less characterized by fundamentals and more characterized by behavioral factors (Kostin, Runge & Mamedova, 2022). Hence, it becomes imperative to study behavioral factors along with the fundamental factors.

In contrast, RMW factor remains redundant during the pandemic period, suggesting that the profitability factor has offered limited contribution to efficacy of factor model in India. RMW Factor was redundant during the full period analysis as well. The results are consistent with O'Donnell, Shannon, Sheehan and Ashraf (2024).

Table 5. Factor Spanning Test (Sub-Period Analysis)

Panel A: FF5F (Stable Period)							
	Intercept	MKT ₅	SMB ₅	HML ₅	RMW	CMA	Adjusted R ²
MKT ₅	-0.045*	—	0.547*	0.161	-0.878*	-0.487	0.40
SMB ₅	0.024*	0.371*	—	0.401***	0.169	0.191	0.27
HML ₅	-0.009**	0.046	0.171***	—	-0.181	0.356**	0.19
RMW	-0.008**	-0.232*	0.066	-0.165	—	0.060	0.22
CMA	-0.000	-0.100	0.058	0.252**	0.047	—	0.06
Panel B: FF5F (Pandemic Period)							
	Intercept	MKT ₅	SMB ₅	HML ₅	RMW	CMA	Adjusted R ²
MKT ₅	-0.001	—	0.527**	0.104	-1.316*	-1.425**	0.42
SMB ₅	0.009	0.274**	—	0.302	-0.329	0.540	0.25
HML ₅	-0.012*	0.017	0.096	—	0.107	-0.160	-0.05
RMW	-0.006	-0.175*	-0.084	0.086	—	-0.355***	0.31
CMA	0.009	-0.139*	0.101	-0.094	-0.260***	—	0.14

Note: * significant values at 1% LOS, ** significant values at 5% LOS, *** significant values at 10% LOS.

Refer to Panel B and C of Table 1 for description of fundamental factors.

Source: based on authors' calculation.

However, another major finding of sub-period analysis is CMA factor, which is redundant during the whole sample period, becomes a significant factor (significant intercepts) during the pandemic period. This indicates that investors become conscious regarding how firms are displaying their investment patterns. Investors prefer the firms with conservative investment strategies over the firms with aggressive investment strategies (Fama & French, 2015).

CONCLUSION

The asset pricing literature has debated unravelling of a superior asset pricing model over the period of time. FF3F was proven as a benchmark model in India. However, there is a necessity for a better asset pricing model, since mispricing in the Indian equity market still persists. The current study examines the effi-

cacy of FF5F over the sample period March 31, 2016 to March 31, 2023, thus covering the pre- and post-COVID-19 crisis (2020–2023). The results exhibit that profitability and investment are priced and add to explanatory power of the benchmark model. As a result, compared to other asset pricing models, the FF5F does a plausible job with its ability to explain more anomalies and understanding return dynamics than other competing models. 75% of portfolios in FF5F exhibit insignificant intercepts in comparison to 50% of portfolios in FF3F.

Additionally, the study found a novel finding that profitability factor (in addition to investment factor) becomes redundant in India for said sample period, which was not discovered in earlier literature. This could be due to the fundamental essence of Indian stock market, which is more susceptible to the sentiment of retail investors. Although, it is presumed that these factors would not be fundamentally redundant as the COVID-19 pandemic might have caused temporary distortions in their efficacy due to changing market dynamics, government interventions, and sector-specific repercussions. This is subject to further analysis whether this redundancy is pervasive all across or is specific to any particular sector.

Furthermore, comparative analysis is conducted between two-time frames – Stable Period and Pandemic Period. The results additionally suggested that MKT and SMB factor becomes redundant during the pandemic period. However, this may not hold true during stable period times where these factors are significant. Hence, it can be concluded that the market is not only driven by fundamental factors alone; rather, behavioral factors might contribute towards mispricing in assets during crisis periods.

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Appendix Table 1: Description of Portfolio Groups

Portfolio Group	Portfolio Name
SL	Small Low
SH	Small High
BL	Big Low
BH	Big High
SLWC	Small Low Weak Conservative
SLWA	Small Low Weak Aggressive
SLRC	Small Low Robust Conservative
SLRA	Small Low Robust Aggressive
SHWC	Small High Weak Conservative
SHWA	Small High Weak Aggressive
SHRC	Small High Robust Conservative
SHRA	Small High Robust Aggressive
BLWC	Big Low Weak Conservative
BLWA	Big Low Weak Aggressive
BLRC	Big Low Robust Conservative
BLRA	Big Low Robust Aggressive
BHWC	Big High Weak Conservative
BHWA	Big High Weak Aggressive
BHRC	Big High Robust Conservative
BHRA	Big High Robust Aggressive

Source: the authors.