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TESTING OF FAMA AND FRENCH THREE FACTOR MODEL IN INDIAN STOCK MARKET

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Abstract
The paper tests the relevance of Fama-French three-factor model in explaining the cross-sectional differences in returns in Indian stock market. The study is based on all the companies that are listed on Bombay Stock Exchange BSE 500 index and covers a period of 15 years – from 1st October 2001 to 30 September 2016 using monthly data from CMIE Prowess- the widely used database for academic research in India. The model is tested on portfolios formed on two characteristics – market capitalization (size effect) and ratio of book-to-market equity (value effect). The empirical results show that the Indian equity market exhibits a strong size effect and value effect which are consistent with the findings of Fama and French (1996) for US portfolios and Sehgal (2005) for Indian stocks. Thus, it provides an evidence of the pervasiveness of the Fama French three-factor model in explaining the cross sectional differences of stock returns. This study may provide a strong support for a broader and generalized asset pricing model having multiple risk factors.

Key words: Fama French three factor Model, Size effect, Value effect.

1. Introduction

Asset Pricing Models explain the relationship between risk and return. The Single Index Model developed by Sharpe (1964) explains that only one factor (namely market return) is sufficient to explain variations in returns of a security. The model also suggests that the security or portfolio risk can be divided into two parts, namely, unsystematic risk (also known as diversifiable risk), and systematic risk (also known as non-diversifiable risk). Unsystematic risk is the security specific risk and can be eliminated by changing the portfolio suitably whereas Systematic risk is associated with overall movements in the general market and thus cannot be eliminated. It is also referred to as the market risk. Since unsystematic risk can be diversified, there is a need to diversify the systematic risk in order to maximize the wealth of the shareholder.

Based on the Single Index Model, Sharpe (1964), Lintner (1965) and Mossin (1966) independently developed a model known as the Capital Asset Pricing Model (CAPM). The Capital Asset Pricing Model (CAPM) relates the expected rate of return of a security to its systematic risk which is measured through beta. CAPM is the oldest complete model of asset pricing, and explains the differences in expected returns due to differences in the systematic risks of assets.

After the development of Single Index Model and CAPM, there were many empirical studies that tested whether the model adequately describes the way stock market prices behave in practice. Many empirical researchers have found that there are influences beyond the market that cause stocks prices to move together and this laid to the development of multi-index (multifactor) models. Specifically, these studies have found through their empirical researches that single factor (market) is not sufficient in explaining differences in security returns, as stated by single index model and CAPM. Company characteristics like Firm size (measured in terms of market capitalization) , earning- yield (E/P Ratio) , Leverage Cash flow to price (C/P ratio) and the firm's book-to-market equity ratio. These company characteristics together were found to provide a better explanation than market factor alone for the cross-section of average stock returns.

Fama and French developed a three-factor model in 1992. They empirically examined the joint role of market return, firm's size, firm's book-to-market equity ratio, earning yield (E/P ratio) and leverage in the cross-section of average stock returns using a multifactor approach. They found that (a) the excess market return has some information about average returns; and (b) the combination of size (market capitalization) and book-to-market absorbs the role of leverage and earning yield (E/P) in average stock returns. Based on their empirical findings in Fama and French (1992), Fama and French (1993) propounded a three-factor model, comprising of the market factor and two mimicking portfolios that proxy for common factors in returns relating to size and book to market equity. They showed that their three-factor model captures much of the variations in the cross-section of average stock returns in a portfolio, which is missed by Sharpe's Single Index Model.

2. Review of Literature

The CAPM model developed by Sharpe (1964), Lintner (1965) and Mossin (1966) independently stated that the expected returns of a security (or a portfolio) can be explained by the expected market risk premium, and the degree of sensitivity defined as the 'beta' of the security (or portfolio). The risk of a stock can be decomposed into two components. The first component is the systematic risk (beta), which is related to the overall market and the second component is non-systematic risk, which is specific to the individual stock. Investors are rewarded only for the systematic risk as the unsystematic risk can be diversified away by holding a diversified portfolio of assets.

Basu (1977) found that stocks with lower price to earnings (P/E) ratios provided higher risk adjusted returns than stocks with higher P/E ratios. Banz (1981) found that stocks of firms of smaller size provided higher risk adjusted returns than stocks of firms of larger size. Similar anomalous patterns were found with respect to other fundamentals like leverage , and book-to-market equity .

Fama and French (1992) studied the joint roles of market beta, size, earnings/price (E/P) ratio, leverage and book-to-market equity ratio in the cross-section of average stock returns for NYSE, Amex and NASDAQ stocks over the period 1963-1990. In that study, the authors found that beta has almost no explanatory power. On the other hand, when used alone, size, E/P, leverage and book-to-market equity have significant power in explaining the cross-section of average returns. When used jointly however, size and book-to-market equity are significant and they seem to absorb the effects of leverage and E/P in explaining the cross section average stock returns. Fama and French (1992), therefore, argued that if stocks are priced rationally, risks must be multidimensional.

Fama and French (1993) extended the Fama and French (1992) study by using a time-series regression approach. The analysis was extended to both stocks and bonds. Monthly returns on stocks and bonds were regressed on five factors: Returns on a market portfolio, a portfolio for size and a portfolio for the book-to-market equity effect, a term premium and a default premium. For stocks, the first three factors were found to be significant and for bonds, the last two factors. As a result, Fama and French (1993) construct a three-factor asset pricing model for stocks that includes the conventional market (beta) factor and two additional risk factors related to size and book-to-market equity. They find that this expanded model captures much of the cross-section of average returns amongst US stocks. Thus, Fama and French proposed a three factor asset pricing model by adding these two variables with the CAPM beta. While Fama and French (1992) adopted a cross-sectional regression approach of Fama and MacBeth (1973), Fama and French (1993) used a time-series regression approach.

Fama and French (1995) explored the relationship between risk factors and profitability. They found that high book-to-market equity (BE/ME) firms tend to be persistently distressed and low BE/ME firms are associated with sustained profitability. The returns to holders of high BE/ME stocks are therefore a compensation for holding less profitable and riskier stocks. They showed that book-to-market equity and slopes on HML in the three-factor model proxy for relative distress. Weak firms with persistently low earnings tend to have high BE/ME and positive slopes on HML; strong firms with high earnings have low BE/ME and negative slopes on HML.

Singh and Yadav (2015) did a comparative study on the Capital Asset Pricing Model, the three factor model of Fama and French (1993), and the five factor model of Fama and French (2015) – on Indian stock market . The study is based on the constituent companies of CNX 500. It was found that the three factor model performs better than the Capital Asset Pricing Model. For portfolios formed on investment, the five factor model performs better than the other models. However, the four factor model (without an investment factor) is a more parsimonious model.

3. Objectives

1. Is there a significant size effect in Indian stock returns?
2. Is there a significant value (BE/ME) effect in Indian stock returns?
3. Is the Fama-French three-factor model a better descriptor of return generating process in Indian context as compared to Single Factor Model?

4. Methodology

4.1Sample

The monthly data for the study has been collected for all the firms listed on Bombay Stock Exchange(BSE) 500 index from the CMIE Prowess database- the widely used database for academic research in India from 1st October 2011 to 30 September 2016. After doing the sorting as per the availability of data, the sample companies differ each year from October 2001 to September 2016.

4.2 Definitions

a) Market factor: Market factor refers to the coefficient of risk premium that is (Rm- Rf). It is obtained by regressing assets' excess return with Risk Premium. BSE SENSEX 500 index has been used as the proxy of Market Return to calculate the Risk Premium.

b) Size: Market equity (ME) has been used as the proxy for the size. Market Capitalization (ME) is calculated by multiplying market price per share by the number of shares outstanding. Market capitalization has been calculated in the

beginning of October of each year *t.* Time lag of six three months has been assumed from the end of the financial year as the financial information will be available to the public by companies.

c) BE/ME: BE/ME refers to the ratio of Book value and market value per equity share. It is also termed as *value* factor. BE/ME has been calculated as book value per share in March-end of year *t,* divided by the market value per share March-end of year *t* .

4.4 Portfolio Formation

The Fama-French methodology involves a cross classification of stocks on two dimensions – size, measured by market capitalization (Number of outstanding shares X closing price), and value, measured by the ratio of book value per share to market price per share – B/M ratio. This classification is tabulated below:

		Value as measured by B/M ratio		
		High (H)	Medium (M)	Low (L)
Size	Big (B)	BH	BM	BL
	Small (S)	SH	SM	SL

4.4.1 Methodology used to create Size portfolios

Size portfolio is created at the beginning of October each year based on market capitalization of the firm as on March end of the year t. Top 10% firms by market capitalization are defined as big firms (B) and remaining firms are classified as small firms (S).

4.4.2 Methodology used to create Value portfolios

Value portfolios are calculated at the beginning of October each year based on BE/ME ratio. The sample stocks are sorted in descending order on the basis of value. For the value breakpoints Fama and French (1993) strategy has been followed and the stocks were grouped as below:

- High value group, H , consisted of the top 30% stocks in terms of the B/M ratio.
- Low stocks (low value group), L, comprised the bottom 30% stocks in terms of the B/M ratio.
- The remaining stocks were grouped as Medium (M) stocks.

Thus, six portfolios are created from the intersection of two sizes and three BE/ME Groups and are named as S/L, S/M, S/H, , B/L, B/M, and B/H. for example, S/L portfolio contains stocks of *small* ME(Market Equity) and *low* BE/ME companies, while B/H portfolio represents *big* ME companies with *high* BE/ME ratio. After calculating these portfolios, monthly weighted returns on the six portfolios are calculated for each portfolio starting from Octobet of year *t* till September of year *t*+1. The portfolios are reformed every year in October of year *t*+1.

4.4.3 Size and Value factors return

After calculating the portfolio returns, the next step is to calculate the size and value factor returns namely SMB and HML as stated by the Fama- French Model. The market factor is calculated as (Rm – Rf). To calculate SMB and HML returns, as explained earlier, companies are divided into six groups based on size and the BE/ME ratio. The intersections of the two sizes and three BE/ME groups produce six portfolios of stocks which are used to compute the SMB and HML factor returns. The SMB factor return is the average of return on three small size portfolio i.e. average of (S/L, S/M, & S/H) minus the average of return on three big size portfolios i.e.(average of (B/L, B/M, B/H).

SMB is calculated as : (S/L+ S/M + S/H)/3 - (B/L+ B/M+ B/H)/3

Monthly returns are calculated for each of the portfolio after the portfolio formation. The process was repeated until the portfolios were reconstructed. Similarly, the HML factor return is the average of return on two high BE/ME portfolios i.e. average of (H/S & H/B) minus the average of return on two low BE/ME portfolios i.e. average of (L/S & L/B).The process was repeated until the portfolios were reconstructed.

HML is calculated as : (H/S + H/B)/2 - (L/S+ L/B)/2

4.4.4 Portfolio formation date

Fama and French (1993) formed their portfolios in June of each year after considering a 6-month gap from the fiscal year ends (December) to account for the time taken for the publication of accounting data. As the fiscal year ends for most Indian firms is March, assuming a 6-months gap for publication of accounting data, portfolios have been formed in September of each year. In the size-value portfolio creation, the firms with negative book values have been excluded from the sample.

4.5 Computation of Returns

The adjusted closing price (Adjusted Close) provided by CMIE Prowess is already adjusted for stock splits and other corporate actions but not for dividends. The total return including dividends of day t was computed using prices from BSE for each unique firm identifier using the following formula:

$$\text{Total Return}_t = \ln\frac{\text{Adjusted Close}_t + \text{DPS}_t\ (\text{Adjusted Close}_t / \text{Close}_t)}{\text{Adjusted Close}_{t-1}}$$

where DPS denotes the dividend per share. Using the above formula, buy-and-hold returns have been computed for each size-value portfolio). The weight of each stock in a portfolio was based on the market capitalization on the portfolio reconstitution date (the September year end for the size and value portfolios).

4.6 Estimation of Market Risk Premium

The market portfolio is estimated as the value-weighted portfolio of all the stocks involved in the estimation of SMB and HML factors. The risk-free rate Rf , computed using the 91-days T-bill rate, is deducted from the return of the market portfolio (BSE Sensex 500 index) to obtain the market risk premium or Rm −Rf. The 91-day T-bill rate is sourced from the Reserve Bank of India's weekly auction data. The implied yields have been converted to monthly rates.

5. Examination of explanatory factors of returns

Time series regression is run to examine whether different risk factors, individually or collectively, capture variations in returns. For this purpose, the time series regression equations used are listed below in equations :

a. Regression using the market factor (Rm – Rf) as explanatory variable (the Single Index Model).

Rp-Rf= c + b(Rm-Rf) + e

b. Regression using market and SMB as explanatory factors.

Rp-Rf= c + b (Rm-Rf) + s(SMB) + e

c. Regression using market and HML as explanatory factors.

Rp-Rf= c + b(Rm-Rf) + h(HML) + e

d. Regression using SMB and HML as explanatory factors.

Rp-Rf= c + s(SMB) + h(HML) + e

e. Regression using market, SMB and HML factors (the Fama French Model)

Rp-Rf= c + b(Rm-Rf) + s(SMB) + h(HML) + e

Where:

Rp is the monthly return of a certain portfolio (S/L, S/M, S/H, B/L, B/M, B/H). *Rf* is the monthly risk free rate. Rm is the monthly return on market. For the purpose of this study, the BSE SENSEX 500 index has been used as a surrogate for market. *SMB* (Small minus Big) represents the size factor. HML (High minus Low) represents the BE/ME (value) factor. The loadings *b , s ,and h* are the slope coefficients in the time series regression.

The significance of the explanatory factor(s) is tested using t-test. The test examines the null hypothesis that the slope of a regression line does not differ significantly from 0.The statistical significance of the t-value is specified using P-Value.

6. Analysis and Result

The analysis has been done using Eviews 8.

Table I: Mean monthly excess returns on the Size (ME)– Value (BE/ME) sorted portfolios

		Value		
		Low	Medium	High
Size	Small	0.029155	0.042096	0.059906
	Big	0.028214	0.049687	0.019745

Table-I shows the mean monthly returns over the risk free return (excess return) on the Size and BE/ME sorted portfolios. The six Size-BE/ME portfolios exhibit an excess return ranging from 0.029% to 0.019% . The portfolio returns confirm the Fama (1993, 1995) evidence that there is a negative relation between size and return except for the BH portfolio here. Various researchers have put forth various explanations for this size effect. One of the most frequently mentioned explanations holds that small shares may contain some systematic risk that is not adequately captured by the underlying model. As a result, the market uses a high discount rate to discount its future cash flows giving lower prices and, thus, higher returns. Since empirical models are not capturing at present these risks, small stocks tend to exhibit a higher returns adjusted for known sources of risks.

Furthermore, as shown in table I, the relation between BE/ME and excess return is positive except for the BH portfolio. Various researchers attempted to explain the value premium in stock returns. Fama and French (1992) suggested that it is possible that the risk captured by BE/ME is the relative distress factor. The market judges this relative risk distress factor and accordingly, price the stock which are signaled through BE/ME ratios in the market. Hence, it can be inferred that stocks with high ratios of book equity to market equity is signaling high distress risk and therefore, have higher expected returns than those firms having low BE/ME ratio. Hence, it seems as per Table-I that the Indian equity market is exhibiting a strong size effect and value effect.

Table II : Summary statistics of Market, Size, and Book to Market

	Mean	**Standard Deviation**
Market	0.030707	1.458264
SMB	0.002365	0.929104
HML	0.041325	1.048146

Table II provides the summary statistics of risk premiums of the factors viz., market, size, and value. The average value of RM - RF (average premium per unit of market factor) is 0.03% per day. The average SMB factor return (the average premium for the size factor in returns) is about 0.002% per day. It shows that in Indian markets, the size premium is about 1.14 times the market premium. The average HML factor return (the average premium for the value factor in return) is 0.04% per day.

Table III : Correlations Coefficients

	SMB	HML	Market
SMB	1	0.166687	-0.3588
HML		1	0.023785
Market			1

Level of significance: 5%

Table III shows that the degree of correlation between SMB and HML is 0.16 which is very less. Similarly, the degree of correlation between SMB and Market is -0.35 which shows there is negative relation between SMB and Market risk premium and low degree of correlation. Also, there exists low degree of correlation between HML and Market to the extent of 0.02. Thus, the following variables can be used to run the regression as there will not an issue of multicollinearity .

Table IV reports the results of the regression run in five panels from A to E. **Panel A** shows the regression results taking market factor as explanatory variable of the stock returns. The coefficients of the market factor is represented by b. Panel A (Table IV) shows that the slopes of the market factor (b) indicate that betas are not varying significantly between. The results (see Table IV) show that the market factor coefficient (b) is positive and highly significant for each of the six portfolios. The

t statistics of all the beta (b) values, have also been reported and are more than 7, and P-values, as reported in the table, are not different from 0, implying statistical significance of beta in explaining cross section of expected returns. The adjusted R^2 is value ranges from 0.36 to 0.97 for the sample portfolios. The highest adjusted R^2 value is seen for BL portfolio. The average of adjusted R^2 is 68.70%. It implies that market factor does explain a proportion of the common variation in stock returns.

Panel B Table (IV) shows the results of regression where the market factor, and size factor have been taken as explanatory variables. simultaneously. The table shows the coefficients of the market and size factors, respectively; reports the t-values of the market and size factors, respectively; and also reports the significance of the t-values i.e. P- Values of the market and size factors, respectively along with the fitness of the model i.e. adjusted R^2.As can be seen from the table, values of all the b are positive whereas that of s are positive as well as negative. Both b and s values are highly significant for all of the six portfolios. The average of the adjusted R^2 is 77.87%. The high adjusted R^2 values confirm that the size factor in association with market factors contributes noticeably towards the explanation of variations in stock returns. It also indicates that the market and SMB factors together capture a greater proportion of common variations in returns as compared to Single Index Model.

Panel C (Table IV) presents the explanatory power of market factor and value factor in explaining returns .The table shows the coefficients of the market and value factors, the t-values of the market and value factors and, the significance of the t-values i.e. P- Values of the market and value factors. Finally the table reports the fitness of the model i.e. adjusted R^2. It is observed in the table that market slopes and the value factor coefficient (h) are significant for all six portfolios are statistically significant at 5% significance level in all cases. The average of the adjusted R^2 is 78.94% which shows a marginal improvement in explanation of the cross sectional differences in returns as compared to the regression model using market factor alone.

Panel D (Table IVI) shows the regression results where the size factor and the value factor are introduced simultaneously. The table shows the coefficients of the size and value factors, respectively, the t values of the size and value factors and, reports the significance of the t-values i.e. P- Values of the size and value factors, finally, reports the fitness of the model i.e. adjusted R^2. As can be seen from the table, the SMB slopes(s) are statistically insignificant for the small stock, namely, SM and SL stock portfolios For value factor, the HML slopes are statistically significant for all the except for BL portfolio implying strong significance of value factor.. The average of the adjusted R^2 is 19.79% indicating that in the absence of the market factor, the SMB and HML fail to capture significantly common variations in returns.

Panel E Table (IV) shows the regression results of equation using all the three-factors viz. market, size, and value to explain returns. The table shows the coefficients of the market, size, and value factors, the t-values of the market, size, and value factors and reports the significance of the t-values i.e. P- Values of the market, size and value factors. Finally, the table reports the fitness of the model i.e. adjusted R^2. It is observed from the table that the coefficients of the market slope (b) are all positive whereas the coefficients of SMB slope (s) and HML slope (h) are positive as well as negative. All the coefficients of b, s and h are statistically significant in all the cases. The mean adjusted R^2 of the regression model is 86.27 % indicating that the three factor model provides the best description of portfolio returns.

Five regression models were run for each of the six portfolios with the following Independent (Explanatory variables) as shown in the table:

Table IV: Regression Analysis

PANEL A											
Explanatory Variable	**Portfolio**	**b**	**t(b)**	**P-value t (b)**	**S**	**t(s)**	**P-value t (s)**	**h**	**t(h)**	**P-value t (h)**	**Adjusted R Square**
Market	BH	1.143	54.283	0.0000							0.36453
	BM	1.1043	137.2	0							0.7691
	BL	0.9952	463.83	0							0.97441
	SH	0.8585	87.506	0							0.57535
	SM	0.8412	113.53	0							0.69519

	SL	0.7879	128.04	0							0.74365
PANEL B											
Explanatory Variable	**Portfolio**	**b**	**t(b)**	**P-value t (b)**	**S**	**t(s)**	**P-value t (s)**	**h**	**t(h)**	**P-value t (h)**	**Adjusted R Square**
Market and SMB	BH	1.0544	46.957	0	-0.37456	-10.5622	0				0.37793
	BM	1.0475	125.26	0	-0.24856	-18.9375	0				0.78284
	BL	0.9793	440.69	0	-0.06942	-19.9043	0				0.97608
	SH	1.0609	144.09	0	0.885076	76.59084	0				0.79164
	SM	0.9964	182.19	0	0.67883	79.08568	0				0.85532
	SL	0.9216	211.98	0	0.584756	85.69484	0				0.88852
PANEL C											
Explanatory Variable	**Portfolio**	**b**	**t(b)**	**P-value t (b)**	**S**	**t(s)**	**P-value t (s)**	**h**	**t(h)**	**P-value t (h)**	**Adjusted R Square**
Market and HML	BH	1.1279	63.848	0				1.154874	46.51009	0	0.55285
	BM	1.0995	144.7	0				0.278481	26.34182	0	0.79432
	BL	0.9971	536.67	0				-0.11237	-43.4726	0	0.98082
	SH	0.845	134.52	0				0.788549	90.22361	0	0.826
	SM	0.8333	139.89	0				0.46121	55.64883	0	0.80309
	SL	0.7838	137.33	0				0.241254	30.38197	0	0.77962
PANEL D											
Explanatory Variable	**Portfolio**	**b**	**t(b)**	**P-value t (b)**	**S**	**t(s)**	**P-value t (s)**	**H**	**t(h)**	**P-value t (h)**	**Adjusted R Square**
SMB and HML	BH				-1.17585	-34.7104	0	1.311603	43.49927	0	0.35024
	BM				-0.9233	-39.8324	0	0.451289	21.96381	0	0.24423
	BL				-0.62329	-31.7392	0	0.012718	0.730607	0.465	0.15376
	SH				0.137954	6.758104	0	0.796129	43.9977	0	0.2745
	SM				0.02655	1.325791	0.185	0.484863	27.3137	0	0.12123
	SL				0.015953	0.843289	0.3991	0.264834	15.79317	0	0.04396
PANEL E											
Explanatory Variable	**Portfolio**	**b**	**t(b)**	**P-value t (b)**	**S**	**t(s)**	**P-value t (s)**	**H**	**t(h)**	**P-value t (h)**	**Adjusted R Square**
Market, SMB and HML	BH	0.99	53.816	0	-0.57993	-19.8177	0	1.221389	50.53683	0	0.58456
	BM	1.0248	132.86	0	-0.32313	-26.3249	0	0.328699	32.35533	0	0.81677
	BL	0.9866	502.9	0	-0.04553	-14.5853	0	-0.1053	-40.7535	0	0.98151
	SH	1.0143	354.38	0	0.73198	160.7022	0	0.674793	178.9996	0	0.96877
	SM	0.971	240.6	0	0.595177	92.67779	0	0.368715	69.37117	0	0.92187
	SL	0.9109	223.68	0	0.549391	84.77997	0	0.155874	29.06318	0	0.90301

6.1 Testing of significance of intercept

The regression results in Table IV suggest that the market, SMB and HML proxy for common risk factors in returns. After

this, it was verified whether the proxy risk factors suffice to explain the returns on portfolio. If the explanatory factors are suitable and sufficient proxies for underlying common risk factors, the intercept of the time series regression of excess returns on the mimicking portfolios should not be significantly different from 0. Table lays out the intercept results for regression equations in stated above in five different panels.

Table V shows the intercept values of the regression equations, the t-values of intercepts and; the significance of the t-values i.e. P- Values of the intercepts. Using the single factor model in Panel A and two factor model in Panel B, the intercept values are statistically significant for SH portfolio at 5% level. However, all the sample intercepts are statistically insignificant in the three-factor model framework. These intercept term confirm that the three-factor model does capture most of the variations in stock returns, that is missed by single factor model.

Table V: Intercept

PANEL A				
Explanatory Variable	**Portfolio**	**C**	**t(c)**	**P-value t (c)**
Market	BH	0.0000805	0.00257	0.9979
	BM	0.015778	1.344064	0.179
	BL	-0.00235	-0.74927	0.4537
	SH	0.033543	2.344145	0.0191
	SM	0.016265	1.505144	0.1323
	SL	0.004959	0.552579	0.5806
PANEL B				
Explanatory Variable	**Portfolio**	**C**	**t(c)**	**P-value t (c)**
	BH	-0.0017	-0.0547	0.9564
Market and SMB	BM	0.018111	1.590766	0.1117
	BL	-0.00169	-0.55963	0.5758
	SH	0.025236	2.517647	0.0118
	SM	0.009894	1.328888	0.1839
	SL	-0.00053	-0.08929	0.9289
PANEL C				
Explanatory Variable	**Portfolio**	**C**	**t(c)**	**P-value t (c)**
Market and HML	BH	-0.0266	-1.01168	0.3117
	BM	0.004416	0.398271	0.6904
	BL	0.00224	0.826324	0.4087
	SH	0.00137	0.149466	0.8812
	SM	-0.00255	-0.29363	0.7691
	SL	-0.00488	-0.5864	0.5576
PANEL D				
Explanatory Variable	**Portfolio**	**c**	**t(c)**	**P-value t (c)**

	BH	-0.02121	-0.66923	0.5034
SMB and HML	BM	0.033222	1.56342	0.118
	BL	0.029163	1.619879	0.1053
	SH	0.026679	1.425668	0.154
	SM	0.021996	1.19813	0.2309
	SL	0.018173	1.047893	0.2947
PANEL E				
Explanatory Variable	**Portfolio**	**c**	**t(c)**	**P-value t (c)**
Market, SMB and HML	BH	-0.03089	-1.2187	0.223
	BM	0.0054	0.515961	0.6059
	BL	0.002379	0.893745	0.3715
	SH	-0.00086	-0.22106	0.8251
	SM	-0.00436	-0.79709	0.4254
	SL	-0.00656	-1.18667	0.2354

7. Conclusion

The study tested the relevance of Fama- French three-factor model in explaining the cross sectional differences in portfolio returns, in the Indian context systematically and robustly. A large sample data has been pooled from wide range of companies and periods. It was found that there is a strong size and value effects in Indian stock market. The pearson's correlation between market and SMB and SMB and HML is significant at 5% level. The correlation result suggests some overlapping amongst the factors and hence, explanatory factors are not orthogonal to each other. The Fama-French three-factor model explains the cross section of average stock returns that is missed by single Index model. The highest value of adjusted R^2 is seen for BL portfolio, that is, 98% for the Fama and French three factor model. It is observed that overall the FF three-factor model explains the variation in cross section of stock returns in a meaningful manner. It is also note that the three-factor model is robust in the sense that the value of alpha intercept is statistically insignificant in the case of most of the portfolios. The results are consistent with the findings of FF (1996) for US portfolios and Sehgal (2003) for Indian stock market and provide evidence of the pervasiveness of the FF three-factor model in explaining the return generating process. This study provides support for a broader, rational asset pricing model in which there are multiple risk factors.

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