Dynamics of Size and Value Factors in Stock Returns : Evidence from India

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Abstract

This paper evaluated the cross sectional relationship between firm characteristics : size and value with risks and expected returns in the Indian stock market on different horizon of time from previous studies. Furthermore, the study deployed different breakpoints for market capitalization (median, market capitalization, and BSE breakpoints) and price to book ratio (equal weighted and Fama-French breakpoints). Motivation for using different breakpoints for market capitalization and price to book ratio was to check the sensitivity of the results. Average stock return patterns, residual graphs, R^2, Fama - MacBeth cross sectional test, and GRS test confirmed the inability of both CAPM and Fama-French three factor model to capture the risk-return relationship. Furthermore, all test results confirmed that there was a strong size effect and mild value effect in the Indian stock market. Finally, the study found that MC breakpoints were sensitive to the results, but P/B breakpoints were not sensitive to the results.

Key words : **size, value, Fama-MacBeth regression, GRS, residuals**

JEL Classification : GOO, G01, G12

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Risk and uncertainty are the two major factors that make investment and valuation decisions complex. To address this issue, several attempts have been made by researchers, academics, and practitioners. Pricing of an asset is a complex process in the backdrop of how the asset is exposed to several factors. Contemporaneous evidence on asset pricing shows that equity returns are exposed to different risk factors such as firm characteristics, particularly size and value. The present study addresses the effect of firm characteristics in stock returns with respect to different time horizons. Different asset pricing models are used to capture the variance in risk - return relationship. The asset pricing models' performances are tested using residual graphs followed by more standard tests like GRS test. To identify the factor contributions in explaining the variance in returns, Fama - MacBeth cross sectional regression is used. Finally, the study addresses empirically whether the change in MC and P/B breakpoints has any significant effects on the return patterns.

Review of Literature

Sharpe (1964) introduced the capital asset pricing model (CAPM) which empirically proved that rational investors could gain higher returns if one is ready to take extra amount of risk for extra amount of gain. This argument suggested that assets returns and their market betas are linearly related. CAPM was subsequently

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validated by Lintner (1965), Mossin (1966), and Fama (1968). Jensen, Black, and Scholes's (1972) two factor model, also known as zero betas CAPM, found beta as an important determinant of security returns. Fama and MacBeth (1973) tested the two factor model for multi period, and their study concluded that the two factor model was useful in certain conditions over CAPM. Ross (1976) introduced a multifactor model called arbitrage theory of capital asset pricing (APT model). The APT model considered multiple macroeconomic factors in calculation of returns and market premium. The APT model gave arbitragers profits for the securities that were mispriced. Banz (1981) found a relationship between stock returns and market value of NYSE stocks known as size effect.

Small size firms tend to have higher risk adjusted returns than the medium or large size firms. Also, the size effect is not linear in market value that was missed out by CAPM. Basu (1983) examined the relationship between the earning yield (P/E), firm size, and stock returns. The study confirmed that stocks with higher P/E ratios tend to provide higher average returns than stocks with smaller (P/E). The study further confirmed that the effect of P/E ratios was not totally independent of size and value effects. Keim (1983) found the seasonality effect and that was more pronounced in the month of January. The study concluded that there was a significant difference of risk adjusted returns between the smaller and higher size group of firms. Further study by Roll (1983) confirmed the seasonality effect in stock returns. Banz and Breen (1986) introduced look ahead and ex-post selection bias while forming the portfolio on the P/E basis. The study further argued that using of different databases exhibited different results. A sizable number of studies by Bhandari (1988) ; Gibbons, Ross, and Shanken (1989) ; Jaffe, Keim, and Westerfield (1989) ; and Lo and MacKinley (1990) etc., found that size was an important determinant of stock returns other than beta.

The period from 1960s to 1990s saw several developments in the field of asset pricing. Fama (1991) reviewed details about the innovation in the field of asset pricing over the years, discussed about market efficiency, and the possible way forward. The market efficiency theorem introduced a new dimension in the field of investment which states that asset prices reflect all available information prevailing in the market. The market efficiency theorem also raised questions on the ethical practices prevailing in the operations of capital markets. The study further discussed about the pros and cons of CAPM and other factor models. Fama -French (1992) found that size and book to market (BE/ME) was able to capture more cross sectional variation for the average stock returns. The study shed light on stock returns that were associated with five factors namely beta, leverage, size, BE/ME, and earning to price ratio. Fama-French's (1993) study was conducted on these five common risk factors related to both stocks and bond returns. The study also proposed a three - factor model for asset pricing with market, size, and BE/ME. With the combination of these three factors, they developed two mimicking portfolios namely SMB (small minus big) based on market equity, a measure of company size and HML (high minus low) based on BE/ME, a measure of company value. The study found that the mimicking portfolios described above were able to explain the average returns portfolios. Going further, Fama - French (1995) showed that size and market in earnings explained returns, whereas BE/ME in earnings were not linked to the returns. Also, due to the presence of many other anomalies, the three factor model was challenged by many researchers : Haugen and Baker (1996) ; Cohen, Gompers, and Vuolteenaho (2002) ; Fairfield, Whisenant, and Yohn (2003) ; Titman, Wei, and Xie (2004) ; Fama - French (2012) ; Zaremba and Konieczka (2014) ; and Fama-French (2015).

The above studies were conducted for matured markets. However, it is imperative to examine the impact of emerging markets' (like India) contribution to the existing literature of asset pricing. Hence, we reviewed important empirical works carried out in the Indian context, which are discussed in the next paragraph.

Connor and Sehgal (2003) made a maiden attempt to test whether stock returns were influenced by firm characteristics such as size and value. The study also verified whether the average returns patterns of portfolios were well described or captured by the globally accepted asset pricing models such as CAPM and Fama-French three factor (FFTF) model. The study results showed strong evidence for size and value effects in return patterns in the Indian market. Furthermore, the study found the FFTF model superior to CAPM in terms of capturing the average returns on portfolios formed on size and value.

Kumar and Sehgal (2004) confirmed the size effect for market and non-markets ; whereas, weak value effect considered the P/E ratio as an alternative measure of firm value. Sehgal and Tripathi (2005) tested the market efficiency theorem in the Indian market. The study raised questions on the operational efficiency of the Indian stock market in terms of market efficiency and confirmed the presence of strong size effects using six different proxies of the size factor variable. Sehgal, Subramaniam, and De La Morandiere (2012) found that stock returns were positively related to the size, value, accruals ; whereas profitability was negatively related to the stock returns. Sehgal and Balakrishnan (2013) revealed that there was a strong size and value effect in the Indian stock market. Balakrishnan and Maiti's (2016) study in the Indian context revealed the presence of size effect in the micro stocks. Recent study by Das and Barai (2016) and Balakrishnan (2016) in the Indian market found that stock returns were highly influenced by the size and value factors.

From the above review, we identify a strong research gap as only few of the previous works carried out in the Indian context have attempted to test size and value effects by forming portfolios using the value weighted approach. Furthermore, we also found that no previous works in India have experimented with size and value effects by constructing diversified portfolios (25 portfolios) which may have low variances as the value weighted approach is used with different breakpoints. Hence, we, in this paper, test size and value effects in stock returns by forming portfolios using value weighted (VW) approach with different breakpoints and also evaluate the ability of asset pricing models such as one factor CAPM, Fama-Macbeth model, and Fama-French three factor model in explaining average returns on portfolios formed on size and value. Furthermore, there are no empirical evidences showing whether the study results are affected due to a change in the P/B breakpoints; and the finale of the study addresses the same. The motivation behind checking different breakpoints of size and P/B ratio is to check the sensitivity of the results.

Research Hypotheses

The paper has the following testable hypotheses :

- **H01 :** There are size and value effects in stock returns ; even portfolios are formed using the value weighted approach.
- **Ha1 :** There are no size and value effects in stock returns.

- **H02 :** The Fama - French three factor model is able to explain the average returns on portfolios vis-à-vis one factor CAPM.
- **Ha2 :** The Fama - French three factor model is not able to explain the average returns on portfolios vis-à-vis one factor CAPM.

- **H03 :** The results are sensitive to the MC & P/B breakpoints.
- **Ha3 :** The results are not sensitive to the MC & P/B breakpoints.

Data and Methodology

The study begins with the selection of 500 companies listed on the Bombay Stock Exchange (BSE 500) index, and data were taken from Centre for Monitoring Indian Economy's (CMIE) Prowess database, the widely used database in India for academic research. Out of 500 companies, 491 companies have valid and required data for the study. Hence, our study sample size is of 491 companies covering the period from July 1999 to April 2015. We used the data of month end adjusted closing share prices [1], market capitalization (MC) [2], and price to book (P/B) [3] ratio for the sample companies. All essential steps required for the data originality and integrity were taken care of in order to ensure that estimation and analysis of the study are flawless and appropriate. MC represents the company size and the value of MC is converted to log natural value to maintain uniformity in the data range for further estimation purposes. P/B ratio shows the reverse of BE/ME book value of common equity to market value of common equity, and P/B is used as the proxy of company value. BSE-200 index monthly excess returns [4] acts as the proxy for market returns (R_m). Finally, risk free rate of return, 91 day T-bill [5] returns are used as a proxy for the risk free rate (R_f) and the same is taken from the database of Reserve Bank of India [6] (RBI).

Next, we present the methodology for constructing the portfolios. Fama-French (1993) allocated portfolios using the same breakpoints that are used in the New York Stock Exchange (NYSE) for sorting the stocks on MC BE/ME to avoid the domination of micro stocks in American Stock Exchange (AMEX) and National Association of Securities Dealers Automated Quotations (NASDAQ). This motivated us to form portfolios using different breakpoints to check the sensitivity of the portfolios. Hence, in line with the FFTF model (1993), we formed portfolios as follows. In the month of June year *(t)*, we ranked the sample stocks based on market capitalization and formed five equally weighted portfolios. Portfolio one (P_1) is the smallest portfolio that has the bottom 20% of the sample stocks, while portfolio five (P_5) is the biggest portfolio which contains top 20% of the sample stocks. We use the breakpoints of 20 : 20 : 20 : 20 : 20 for the portfolio formation.

Next, in the month of June, year *(t)* we also rank the sample stocks on P/B ratio and construct five equally weighted portfolios. Portfolio one (P_1) is the portfolio that has the lowest value stocks while portfolio five is the (P_5) portfolio that comprises of stocks with high value stocks. We use the same breakpoints for P/B classification as that of MC. Then, we form 25 portfolios (P_1 to P_{25}) from the intersection of five size based portfolios and five value based portfolios. P_1 consists of the small MC stocks and low value P/B stocks ; whereas P_{25} consists of big MC stocks and high value P/B stocks. Then each portfolio's value weighted excess returns are calculated from July 1999 *(t)* to June 2000 (t+1). Next revision of portfolio formation is done in year 2000, and the process of portfolio revision continues till 2015. Finally, mean excess returns [7] on each portfolio are calculated for 190 months from July 1999 to April 2015.

(i) Second Sort : Next, we describe the procedures for constructing mimicking portfolios. In the month of June each year, we rank the sample stocks on MC and make two weighted groups in the ratio of 10 : 90 (we also check for median (50: 50) and BSE (30 : 70) breakpoints). The bottom 10% of the stocks are grouped as small and top 90% of the stocks are named as big group. Further, we also rank the sample stocks on P/B ratio in the month of June each year and create three equally weighted groups of portfolios. We use the breakpoints of 33.33% : 33.33% : 33.33%, respectively for the portfolio formation. Fama-French (1993) suggested the BE/ME breakpoints 30% : 40% : 30%, which is arbitrary, and change in P/B break points is not sensitive to the results. To check this argument empirically, we use 33.33% : 33.33% : 33.33% break points P/B classification which are different from Fama-French (1993) breakpoints. In the ranking, bottom 33.33% of the sample stocks are called as low *(L)* value stocks, next median 33.33% of the stocks as medium *(M)* value stocks, and top 33.33% of the sample stocks as high *(H)* value stocks. Then from the intersection of the two groups of MC and three groups of P/B ratio portfolios, six portfolios are created namely *S/L, S/M, S/H, B/L, B/M,* and *B/H*. The *S/L* portfolio comprises of small size and low value stocks, while *B/H* comprises of big size and high value (growth) stocks. Then each portfolio's value weighted excess returns are calculated from July 1999 *(t)* to June 2000 (t + 1). Next, the revision of ranking process is done in the year 2000, and this process continues each year till 2015. Finally, mean excess returns on each portfolio are calculated for the 190 months from July 1999 to April 2015.

(ii) Motivation for Building of Mimicking Portfolios : Mimicking portfolios are *SMB* and *LMH* (we use *LMH* instead of *HML* in FFTF regression (see Sehgal et al., 2012 ; Sehgal & Balakrishnan, 2013), which are expanded in the later section, and are formed on firm economic fundamentals such as firm size and value. Fama - French (1992) documented that size and BE/ME of the firm are not just ad-hoc variables ; rather, they are strongly associated with firm economic fundamentals. More interestingly, they bring important revelations on the relationship between firm profitability and BE/ME. In a normal environment, firms that maintain high book price of the common equity to market price of the common equity are characterized to be low earnings, while firms that are with low book price of the common equity to market price of the common equity tend to have high earnings. In addition to the significance of BE/ME over profitability, Fama-French (1992) found that small firms based on market capitalization earn higher returns on assets vis-à-vis big firms. This phenomenon continues even when the BE/ME effect is controlled. Hence, it is more appropriate to build mimicking portfolios using the above firm fundamentals.

Next, we present procedures for constructing mimicking portfolios. First, *SMB* stands for small minus big, a mimicking portfolio which reflects the risk factor of portfolio returns in relation to company size. *SMB* forms by subtracting monthly simple weight average returns on three big stock portfolios namely *B/L, B/M,* and *B/H* from monthly simple average returns on three small stock portfolios namely *S/L, S/M,* and *S/H*. The determination formula for *SMB* is as follows:

$$SMB = (S/L + S/M + S/H)/3 - (B/L + B/M + B/H)/3 \qquad (1)$$

Next, *LMH* stands for low minus high, a mimicking portfolio which reflects the risk factor of portfolio returns in relation to company value. *LMH* is formed by subtracting monthly simple weighted average returns on two high value (growth) stock portfolios namely *(S/H* and *B/H)* from monthly simple average returns on low value stock portfolios namely *S/L* and *B/L*. The determination formula for *LMH* is as follows :

$$LMH = (S/L + B/L)/2 - (S/H + B/H)/2 \qquad (2)$$

Fama-French (1993) estimated that *HML* stands for high minus low, and mimics the risk factor associated with company value. They formed *HML* using BE/ME*,* while this study estimates *LMH* (see Sehgal et al., 2012 ; Sehgal & Balakrishnan, 2013) using P/B ratio which is inversely related to BE/ME as BE/ME ratios for the sample companies are not directly available in the data source. Hence, our interpretations of the results of value factor are mirror image to those of the FFTF model (1993). The regression runs between the monthly average excess returns on portfolios and monthly average excess returns on market (R_M) for the whole sample period. The paper uses the prominent market model to run the CAPM regression. The specifications of the market model are stated below :

$$R_{Pt} - R_{Ft} = a + b\,(R_{Mt} - R_{Ft}) + e_t \qquad (3)$$

where,

$R_{Pt} - R_{Ft}$ = Portfolio excess returns (excess of portfolio returns over risk-free rate),
$R_{Mt} - R_{Ft}$ = Market excess returns (excess of market returns over risk-free rate),
a = Extra-normal returns (portfolio returns in excess of returns on market portfolio),
b = Portfolio's responsiveness to market factor (beta coefficient).

The CAPM model shown in equation 3 is a widely accepted asset pricing model and the same is tested with an assumption that it can capture the average returns on portfolios. If the intercepts of the time series regression using CAPM model is zero, it is obvious that the model captures the average returns on portfolios. In case where the empirical results reject CAPM, then monthly average returns on portfolios are further regressed for the FFTF model. The three factor model is stated below :

$$R_{Pt} - R_{Ft} = a + b\,(R_{Mt} - R_{Ft}) + s\,SMB_t + 1\,LMH_t + e_t \qquad (4)$$

where,
SMB mimics the risk factor in returns considering size,
LMH mimics the risk factor in returns considering value,
s and l are the portfolio's responsiveness to (sensitivity coefficients) *SMB* and *LMH* factors, respectively.

(iii) Fama-Macbeth Cross Sectional Regression : The Fama-MacBeth test is the practical test to how the factors (size, value, and beta) explain portfolio returns. It tries to find out premium resulting from exposure to these factors. It is a two stage regression ; at the first stage, each portfolio return is regressed against factors' time series to estimate the factor exposure as shown in the equation (5) :

$$(R_{Pt}-R_{Ft})_{1,t} = a+b_{1,\text{beta}}(R_{Mt}-R_{Ft})_{1,t}+s_{1,smb}SMB_{1,t}+l_{1,t}LMH_{1,t}+{}_{e1,t}$$
$$(R_{Pt}-R_{Ft})_{2,t}=a+b_{2,beta}(R_{Mt}-R_{Ft})_{2,t}+s_{2,smb}SMB_{2,t}+l_{2,t}LMH_{2,t}+{}_{e2,t}$$
$$\vdots$$
$$(R_{Pt}-R_{Ft})_{n,t}= a+b_{n,\text{beta}}(R_{Mt}-R_{Ft})_{n,t}+s_{smb,t}SMB_{n,t}+l_{lmh,t}LMH_{n,t}+{}_{en,t} \quad (5)$$

In the second step, the output from the first step portfolio cross sectional returns are regressed with the factor exposure at each time step. This gives the times series of coefficient for the risk premium. Finally, average for each of the coefficients of factor exposure is calculated that gives the premium expected from unit exposure from each factor over time.

$$R_{Pt}-R_{Ft}=\lambda 0+\lambda rm\,(R_{Mt}-R_{Ft})+\lambda smbSMB_t+\lambda lmhLMH_t+e_t \quad (6)$$

The second stage of the Fama - MacBeth regression reduces the sum square of the errors (reduces the pricing errors) by fitting all points. From the *t*-statistics value, one can estimate whether the explanatory variables are able to capture the variances (Newsy-West (HAC) method used to correct the error terms).

(iv) Explanatory Variables : The Table 1 shows the descriptive statistics for independent variables of the market, *SMB* (mimicking portfolio for size) and *LMH* (mimicking portfolio for company value). The mean excess returns on market (one month returns on market is reduced by one month risk-free rate of interest) is 0.8% per month (t = 1.551). Annual equity premium on market is about 9.5%, which is relatively low in relation to its exposure to several factors. Next, we find a size premium of 3.7% (t = 7) per month on *SMB,* which is the mimicking portfolio of company size. Finally, results estimate a weak value premium of 0.5% (t = 1.022) per month. The Table 2 presents correlation coefficients for three independent variables namely market, *SMB*, and *LMH* being used in the study.

The Table 2 represents the correlation matrix for the explanatory variable. The standard error for correlation is very small for 190 observations and values in the tables are more than three standard errors from zero. There is a positive relationship between R_m and all other variables that is different from Fama-French (2012, 2015). The positive correlation between R_m and *SMB* is obvious ; theoretically, we know that small size companies are more

Table 1. Descriptive Statistics for the Independent Variables

	R_m	*SMB*	*LMH*
Mean returns	0.008	0.037	0.005
Std. dev.	0.078	0.074	0.072
t- statistics	1.551	7	1.022

Table 2. Correlation Matrix for Explanatory Variables

	R_m	*SMB*	*LMH*
R_m	1.000	0.026	0.245
SMB	0.026	1.000	0.136
LMH	0.245	0.136	1.000

risky than the big size companies, hence when the market is a bullish market, one should buy small size companies to gain higher rate of returns. Similarly, we find a positive correlation between R_m and *LMH*. When the market is in upward movement, one will gain from investing in the low P/B stocks. Further, we find that *SMB* and *LMH* are positively correlated. While constructing the portfolio, one should consider these variables to maximize the returns.

Empirical Analysis and Results

The Table 3, Panel A presents mean excess returns on 25 value weighted portfolios sorted on MC and P/B. The average return on portfolios reveals that there is a systematic pattern in returns. The return pattern shows that portfolio one (P_1), which is the combination of small size and low value stocks yields a monthly average return of 6.2% per month, while portfolio five (P_5 : last portfolio of the first row), the combination of big size and low P/B stocks, earns a monthly return of 2.3%. It is also noted that average returns on P_5 is about three times that of P_1. It is further seen that the portfolios of big and low (last portfolio of the first column) and big and high (last portfolio of the last column) yield monthly average returns of 1.8% and 0.6%, respectively. The results show similar pattern as that of Fama - French (1993). The results are consistent with global and Indian evidences (Balakrishnan, 2016 ; Connor & Sehgal, 2003 ; Fama-French, 1993, 2015 ; Sehgal & Balakrishnan, 2013). In every row, the average returns decrease as the P/B value increases, and this effect is known as the value effect. Similarly, in every column ,while descending down, the average returns decrease with increase in size and this effect is known to be the size effect. Hence, the results confirm that equity stocks in the Indian stock market have strong size and weak value effects. Hence, the study results lead to the acceptance of the null hypothesis (H01) that there is size and value effect in stock returns pattern in the Indian market even though the portfolios are formed using the value weighted approach. Panel B and C of Table 3 show the standard deviation and *t*-statistics, respectively.

The Figure 1 gives the visualization of the descriptive statistics of the 25 portfolios based on size and value sorts. The returns pattern shows the size effect prominently and weak value effect.

(i) Asset Pricing Results : Table 4 Panel (A) represents time-series regression results of CAPM for 25 size/value sorted portfolios. The results clearly exhibit that intercept value of portfolio one, which is a combination of small size and low value stocks, is 0.052 and is sufficient enough to reject the CAPM. Any asset pricing or economic model, if it has the explanatory power on average returns, it shall produce zero intercept. The alpha value ranges from 0.000 to 0.052, with absolute average alpha values of CAPM for 25 portfolios to be 0.013. The alpha value is more than 0.05 that confirms the inability of CAPM. Furthermore, statistically, 12 portfolios out of 25 are significantly different from zero (alpha values where *t(a)* is more than 1.96). Hence, time-series regression results confirm CAPM's failure in describing average returns on portfolios for most of the portfolios.

Next, we discuss the regression results of the FFTF model which are detailed in the Panel B of Table 4. The alpha value ranges from 0.000 to 0.017, with average alpha values of the FFTF model for 25 portfolios being 0.005, which is indistinguishable from zero. Statistically, 10 portfolios out of 25 found in the FFTF model are significantly different from 0 (alpha values where *t(a)* is more than 1.96). The empirical results suggest that the FFTF model does contribute significantly to describe the average returns on most of the portfolios, particularly P_1.

Table 3. Summary Statistics of 25 Portfolios Formed on Size and Value Measures

Panel A

Mean Returns

	Low	2	3	4	High
Small	0.062	0.043	0.036	0.033	0.023
2	0.033	0.025	0.023	0.017	0.013
3	0.028	0.015	0.015	0.018	0.011
4	0.018	0.018	0.019	0.009	0.012
Big	0.018	0.016	0.017	0.011	0.006

Panel B : Standard Deviation of 25 Portfolios Sorted on Size and Value Measures

Std. Dev.

	Low	2	3	4	High
Small	0.168	0.11	0.101	0.101	0.106
2	0.126	0.104	0.100	0.090	0.087
3	0.121	0.106	0.104	0.098	0.087
4	0.117	0.115	0.106	0.093	0.082
Big	0.117	0.100	0.093	0.084	0.078

Panel C : *t* - Statistics of 25 Portfolios Sorted on Size and Value Measures

***t* - statistics**

	Low	2	3	4	High
Small	5.146	5.102	5.023	4.521	3.099
2	3.664	3.336	3.220	2.595	2.183
3	3.205	2.075	2.014	2.547	1.814
4	2.137	2.148	2.552	1.402	2.083
Big	2.127	2.274	2.591	1.854	1.224

Figure 1. Surface Diagram for 25 Size and Value Sorted Portfolio Returns

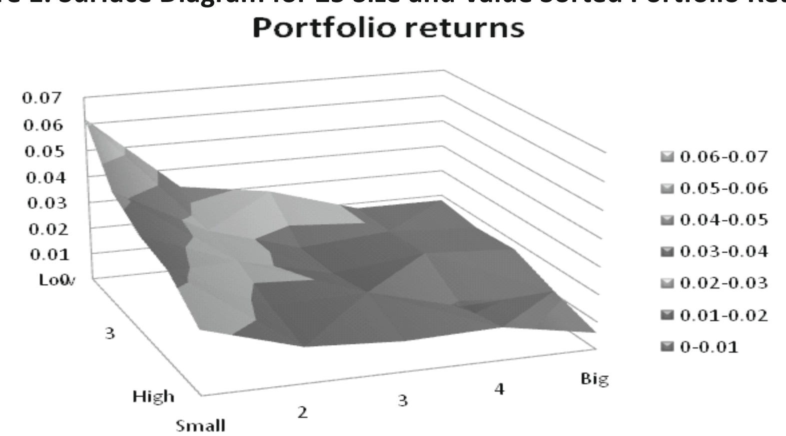


Table 4. Panel A Shows Regression Results of CAPM for 25 Portfolios on Size/Value Factors

$R_{Pt} - R_{Ft} = a + b\,(R_{Mt} - R_{Ft}) + e_t$

	a					*b*				
	Low	**2**	**3**	**4**	**High**	**Low**	**2**	**3**	**4**	**High**
Small	0.052	0.034	0.028	0.024	0.014	1.182	1.081	0.999	1.046	1.109
2	0.023	0.016	0.014	0.008	0.005	1.227	1.075	1.025	0.898	0.947
3	0.018	0.006	0.005	0.008	0.003	1.183	1.077	1.097	1.093	0.942
4	0.008	0.007	0.009	0.000	0.004	1.155	1.230	1.157	1.032	0.892
Big	0.008	0.007	0.008	0.002	-0.000	1.130	1.083	1.052	0.999	0.918

	t(a)					*t(b)*				
	Low	**2**	**3**	**4**	**High**	**Low**	**2**	**3**	**4**	**High**
Small	5.122	5.700	6.019	5.565	3.199	9.051	14.028	16.700	18.904	19.394
2	3.834	3.550	3.302	1.830	1.680	16.035	18.750	18.054	15.705	21.896
3	3.135	1.425	1.341	2.474	0.046	16.062	18.049	19.876	24.199	0.718
4	1.509	1.590	2.407	0.188	1.501	16.472	20.668	22.672	23.422	22.226
Big	1.488	1.839	2.629	1.177	-0.426	15.815	21.452	25.429	32.824	32.217

	R_2				
	Low	**2**	**3**	**4**	**High**
Small	0.303	0.511	0.597	0.655	0.666
2	0.577	0.651	0.634	0.609	0.718
3	0.578	0.634	0.677	0.756	0.991
4	0.590	0.694	0.732	0.744	0.724
Big	0.570	0.709	0.774	0.851	0.846

Table 4. Panel B Records Regression Results of Fama-French Three Factor Model Results for 25 Portfolios on Size/Value Factors

$R_{Pt} - R_{Ft} = a + b\,(R_{Mt} - R_{Ft}) + s\,SMB_t + 1\,LMH_t + e_t$

	a					*b*				
	Low	**2**	**3**	**4**	**High**	**Low**	**2**	**3**	**4**	**High**
Small	-0.006	0.012	0.016	0.017	0.006	1.017	1.007	0.973	1.072	1.133
2	0.009	0.014	0.009	0.007	0.003	1.082	1.001	0.993	0.873	0.973
3	0.013	0.004	0.003	0.005	0.004	1.081	0.990	1.065	1.097	0.943
4	0.010	0.006	0.010	0.002	0.005	1.057	1.149	1.104	1.004	0.906
Big	0.011	0.010	0.014	0.006	-0.000	1.000	0.998	1.014	0.982	0.943

Table contd. on next page

Table 4. Panel B Records Regression Results of Fama-French Three Factor Model Results for 25 Portfolios on Size/Value Factors (Contd.)

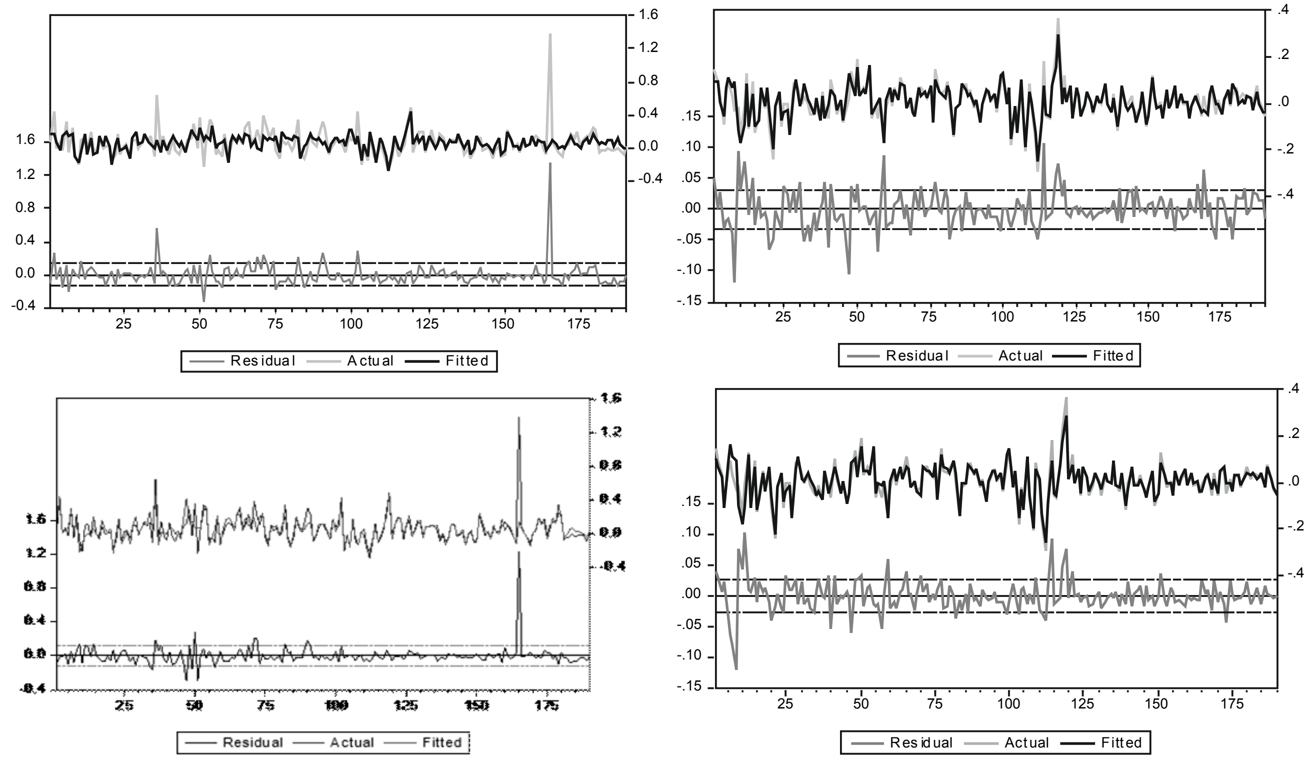
			s					*l*		
	Low	**2**	**3**	**4**	**High**	**Low**	**2**	**3**	**4**	**High**
Small	1.519	0.558	0.316	0.193	0.223	0.561	0.261	0.082	-0.134	-0.129
2	0.293	-0.002	0.118	0.023	0.065	0.606	0.328	0.129	0.116	-0.121
3	0.088	0.031	0.039	0.098	-0.038	0.440	0.378	0.137	-0.027	-0.003
4	-0.087	-0.006	-0.039	-0.048	-0.016	0.442	0.360	0.241	0.126	-0.061
Big	-0.148	-0.130	-0.179	-0.108	-0.011	0.589	0.389	0.185	0.086	-0.106
			t(a)					***t(b)***		
	Low	**2**	**3**	**4**	**High**	**Low**	**2**	**3**	**4**	**High**
Small	-1.196	2.266	3.309	3.688	1.329	16.260	15.411	17.008	19.400	19.957
2	1.860	3.177	2.009	1.732	0.974	17.221	18.130	17.283	16.174	22.123
3	2.241	0.878	0.801	1.312	1.262	15.504	17.628	18.897	23.681	21.174
4	1.781	1.332	2.403	0.537	1.575	15.920	20.236	21.890	22.400	21.895
Big	2.235	2.826	4.344	1.562	-0.069	15.995	22.156	25.665	32.491	32.907
			t(s)					***t(l)***		
	Low	**2**	**3**	**4**	**High**	**Low**	**2**	**3**	**4**	**High**
Small	23.567	8.293	5.368	3.405	3.815	8.174	3.647	1.306	-2.225	-2.085
2	4.531	-0.037	2.000	0.430	1.451	8.790	5.419	2.055	1.966	-2.514
3	1.231	0.544	0.686	2.059	-0.829	5.751	6.143	2.228	-0.545	-0.073
4	-1.274	-0.108	-0.767	-1.054	-0.386	6.077	5.788	4.366	2.573	-1.344
Big	-2.300	-2.802	-4.400	-3.491	-0.382	8.591	7.887	4.267	2.595	-3.380

			R^2		
	Low	**2**	**3**	**4**	**High**
Small	0.851	0.672	0.658	0.680	0.694
2	0.735	0.699	0.651	0.617	0.729
3	0.648	0.698	0.687	0.762	0.719
4	0.658	0.741	0.757	0.754	0.727
Big	0.694	0.785	0.808	0.863	0.856

The R^2 values lies in between 0.303 to 0.991 with an average of 0.672 in case of CAPM.

The FFTF model R^2 values of 25 portfolios are in the range of 0.648 to 0.863 with average R^2 value of 0.797 that supports the three factor model's success. This indicates that about 80% of the variances of the portfolio returns are explained by the FFTF model. The time-series regression results are consistent with recent global findings (Fama-French, 2012, 2015). The regression results also confirm the size and value presence in stock returns by largely loading of size and value factors. The results echo the recent findings in the Indian context (Sehgal & Balakrishnan, 2013). Next, we run cross sectional regression as discussed below. R^2value is always not a good indicator for the model fit but residual graphs give better inference for model fitting. The residual graphs for CAPM and FFTF model for Portfolio 1 (smallest) and Portfolio 25 (largest) are shown in the Figure 2. It is clear

Figure 2. First Row Shows Residual Graph for Portfolio 1 (Smallest) and Portfolio 25 (Biggest) for CAPM; and Second Row for FFTF Residual Graph for Portfolio 1 (Smallest) and Portfolio 25 (Biggest)



from the Figure 2 that residuals are much closer to zero in case of FFTF than that of CAPM for both the portfolios.

(ii) Cross Sectional Regression Results : Next, we run Fama-MacBeth cross sectional regression to test the model and to know which factor is important in explaining variance of excess returns.

From Table 5(A) and Table 5(B), it is clear that both CAPM and FFTF model is rejected at the 5 % level as the *p* - value is less than 0.05. Further, including variables like size and value along with beta, the FFTF model is able to capture more variance in explanatory returns. From the (λ) lambda coefficient, it is observed that the size effect is more significant than the value effect.

The above result is not fully justified unless we test for the efficiency of the factor models. To test the factor model efficiency, we use the GRS test, a well- known test for asset pricing model. It is a statistical test to test whether the hypothesis of sum of alpha is equal to zero.

(iii) Model Performance Test (GRS-Test) (1989) : The Table 6 shows the GRS statistics results. As we have discussed earlier that single *t* - statistics/test is not enough to judge the statistical significance, the GRS (Gibbons-

Table 5(A). Fama-MacBeth Cross Sectional Regression Results for CAPM

Parameters	$\lambda 0$	λrm	Adjusted R^2	*F* - statistics (*p* - value)
Mean	-0.038	0.057	0.162	5.652
Std Deviation	0.184	0.210		(0.026)
t - Statistics	-2.858	3.714		

Table 5(B). Fama - MacBeth Cross Sectional Regression Results for FFTF

Parameters	λ0	λ*rm*	λ*smb*	λ*lmh*	Adjusted R^2	*F*-statistics (*p* -Value)
Mean	0.007	0.001	0.022	0.006	0.609	13.451
Standard Deviation	0.127	0.152	0.053	0.054		(0.000)
t - Statistics	0.740	0.086	5.822	1.423		

Table 6. GRS Test Results and Summary for Factor Models

Factor Model	GRS *F*-Statistics	*p* -Value	Average Absolute Alpha Value	Average R^2
CAPM*	3.24	0.000	0.013	67.2
FFTF*	3.11	0.000	0.005	79.7

* Significant at the 5% level

Ross-Shanken) test is used to check the combined alpha values of portfolio for the time series for each portfolio period combinations. The GRS *F*-statistics tests the sum of alpha intercepts for all portfolios (formed on MC and P/B) is zero. We find CAPM GRS F-statistics of 3.24 ($p = 0.000$) is significant at the 5% level and it is consistent with the results of Connor and Sehgal (2003). Also, though Fama - French (2012, 2015) GRS test rejects the FFTF model, but the study finds that the GRS *F*-statistics value for FFTF is less than CAPM, which confirms the superiority of FFTF.

We also find similar results for the GRS *F*-statistics value of 3.11 ($p = 0.000$ @ 5%) for FFTF, which is less than the 3.24 ($p = 0.000$ @5%) value of CAPM and is consistent with Fama-French's (2012, 2015) findings in the U.S. context and does not support Connor and Sehgal's (2003) findings for FFTF in the Indian context. Hence, the GRS results of FFTF model are found to be the manifestation of the efficiency of the model. Hence, our study's null hypothesis (H02) is proved to be true - the Fama-French three factor model is able to explain more average returns on portfolios than CAPM.

Fama-French (1993) used breakpoints of 30% : 40% : 30% for the classification of stocks based on BE/ME. The above breakpoints are purely arbitrary. Hence, in line with Fama-French (1993), we employ different breakpoints for ranking the securities. The study finds that left hand side portfolios constructed with equal MC breakpoints (50 : 50) comparatively give better results than MC with any other breakpoints of MC that the study used. The results are totally sensitive on the selection of MC breakpoints while P/B breakpoints are not sensitive to the results. The study also accepts the null hypothesis (H03) as the size breakpoints are sensitive to the results and the alternative hypothesis (Ha3) of P/B breakpoints are not sensitive to the results. Further results for other breakpoints are not shown due to the paucity of space. However, the results can be obtained from us upon request.

Conclusion

In this paper, first we address whether the stock returns reveal size and value effects using 25 diversified value weighted portfolios. The average return on portfolio one, which is a combination of small MC and low P/B stocks gives 6.2% mean excess returns per month ; whereas, the portfolio 25 consisting of big MC and high P/B stocks gives 0.6% mean excess returns per month. The portfolio's average returns pattern suggests a strong size effect and weak value effect in the Indian market. Furthermore, Fama-MacBeth cross sectional results on 25 portfolios over the study period strengthens empirically the presence of strong size effect and mild value effect in the Indian market. Both Fama-Macbeth's cross sectional test and GRS test rejects the CAPM and Fama-French three factor model. The study uses different breakpoints of MC (median, market capitalization, and BSE breakpoints) and P/B (equal weighted and Fama-French breakpoints) to study size and value effect in explaining stock returns. The study finds that the test results are sensitive to MC break points, while it is not sensitive to the P/B breakpoints. Due to space paucity, all the breakpoints results are not shown, but will be available on request.

Research Implications, Limitations of the Study, and Scope for Further Research

The study results imply the presence of strong size and weak value effect in the Indian market. The study results are very much sensitive to the MC breakpoint ; whereas, the same are not sensitive to the P/B breakpoints. Fund managers can consider the different breakpoints while constructing portfolios.

The study has a limitation of not including other stock return anomalies such as momentum, profitability, investment etc., and can be incorporated in the future studies. The findings of the study would be of highly useful to the investment analysts to identify economically viable financial assets like equity stocks. The findings would also be beneficial to the global fund managers to make rational allocation of funds on different investible financial instruments.

End Notes

[1] Adjusted closing price of the stocks is set off certain key alterations in capital like stock split, bonus issue, stock dividend, etc.

[2] Market capitalization (price times shares outstanding) is the measure of company size and its original data are given in (₹) crore in the original data source. For the estimation and analysis purposes, we take the natural logarithmic value of market capitalization to ensure that the results and interpretation are flawless.

[3] Companies with high book-to-market equity are called value stocks also described as 'out of favour stocks' and they are inclined to outperform stocks with low book-to-market equity stocks also called 'growth stocks'. Possible explanation for these phenomena that actual growth rates of earnings and cash flows of growth stocks are lower than how they were in the past. Another reason might be investors' overestimation on the earnings and cash flows of growth stocks. In the event when growth stocks fail to achieve the expected growth rates of earnings and cash flows, investors will buy value stocks in the hope that they will increase in value when the broader market recognizes their full potential, which should result in rising share prices (see Lakonishok et al., 1994).

[4] Index monthly excess returns are estimated by taking monthly returns on index reduced by monthly risk-free interest. Monthly index returns are calculated from monthly closing prices of the index which is available on the website of BSE.

[5] Reserve Bank of India (RBI) is the Central bank of India, and it maintains a database for all government securities.

[6] 91 day Treasury bill is one of the money market instruments which is short term as well as risk-free in nature. It is a common practice in terms of research in asset pricing to use 91 day T-Bill rate as the risk-free rate of interest. We also follow it in this study.

[7] Mean excess return on portfolios are computed as return on portfolios reduced by risk-free interest.

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