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Effect of Size and Value in Three Factor Model: Evidence from Indian Equity Market

Debaditya Mohanti[1]

Ravi Kumar Jain[2]

Abstract

The effectiveness of Sharpe-Lintner-Black (SLB) model has always been questioned in the lights of stock market anomalies. Fama-French (1992) proved the incapacity of the market risk factor beta of CAPM in capturing the systematic risk by presenting two other risk factors that is, size and value. The present study attempts to scrutinize the significance of size and value effect in elucidating the stock return under the Indian context. The factor model is examined on 222 sample companies from Nifty 500 index over a period from January, 2007 to April, 2017 by using the approach of Fama-French (1992). The observations of current research corroborate the presence of size and value effect and it is also provide evidences that the Fama-French model may be considered to be a better model than the CAPM in terms of elucidating the variance in the stock's return without compromising on the multicollinearity issue.

Keywords: Asset Pricing Models; Fama-French Model; Size and Value Factor; CAPM.

Introduction

The Asset Pricing models proposed by Sharpe (1964), Lintner (1965) and Black (1972) has facilitated the academic fraternity to enumerate the relationship between the stock return and risk. Since then, several empirical studies have been carried out in various equity markets across the globe that raised serious questions on the efficiency of the Sharpe-Lintner-Black (SLB) model. One of the prominent studies on the asset pricing anomalies that attracted the practitioners was the academic findings of Rolf Banz on "Size Effect". Banz (1981) observed that the small market cap stocks (low MC) had consistently outperformed large market cap stocks (high MC stands for Market Capitalization = Stock's price times Number of outstanding shares) in terms of average return over a period from 1926 through the late 1970s. Another contradiction was proposed by Bhandari (1988) that documented the positive linear relationship between the return on stocks and firm's leverage. However, it is probable that the risk associated with the leverage should be captured by the market beta. Basu (1983) also recorded the value effect in US stock market where the earnings-price ratios (E/P) significantly explain the mean returns on US stocks in an experiment that comprises two more factors, the size and the market beta. Reinganum (1981), Lakonishok and Shapiro (1986) and Fama and French (1992) depicted that the positive linear relationship between stock return and beta (β) disappeared during the period 1963 to 1990. The results recorded by Fama and French (1992) depicted that the simple relationship

[1] Assistant Professor, Management Development Institute Murshidabad.
[2] Professor & Director, Symbiosis Institute of Business Management, Hyderabad

Corresponding author :
Debaditya Mohanti , Assistant Professor, Management Development Institute Murshidabad

between the stock return and beta (β) is Fama-French (1992) proposed that the stock risks are multidimensional and documented that the proposed multifactor model that include size and value factor can resolve most of the anomalies encountered by SLB models. Besides US markets there are several empirical evidences in support of growing popularity of the three factor model in other parts of the globe and hence provide a more robust asset pricing model for market practitioners. In Indian markets, Connor and Sehgal (2003) and Taneja (2010) found "empirical evidences in favor of the three factor Fama-French model. The purpose of the present study is to investigate the significance of size and value factor in explaining the average stock return under the Indian context. The study tested the Indian markets with Fama-French three factor model over a period from January, 2007 to April, 2017".

Data and Methodology

The paper recognizes monthly adjusted stock prices of 222 companies from January, 2007 to April, 2017. The stock prices are adjusted based on stock splits, bonus shares and right issues in order to make the prices comparable over the time period. The sample companies have been drawn from Nifty 500 index, which represents the top NSE 500 companies based on market capitalization covering more than 18 sectors. The sample has been selected based on the availability of the data over a period from January, 2007 to April, 2017, as many present companies of the Nifty 500 index were not listed before January, 2007. The sample accounts for more than 70 percent of the market capitalization as on 30th April, 2017 in the Indian capital market and thus the sample of these companies is reasonably feeble over 50 years from 1941-1990. a true representative of the market performance.

Centre for Monitoring Indian Economy-(CMIE) Database has been used to extract the information. For the purpose of analysis percentage return series of the stock prices have been computed. The return series include only capital gain portion and ignores dividend portion under the premise that the Indian corporate provide extremely small dividend yield (Gupta & Choudhury, 2000). Further, as the portfolio returns have been regressed on the market index returns, which do not include dividend yield, inclusion of dividend component in the stocks might introduce noise in the estimation process.

In this study the stylized portfolios have been created on the basis of certain parameters of the company such as size and value factors. Following the previous research, the market capitalization (MC) has been considered as a measure of company size. Fama-French (1993, 1996) observed that "the value factor entails that the firms with low price to book equity (P/B) ratio should provide higher returns because of having persistently low earnings". Hence, P/B ratio has been employed as a measure of value factor in the present study. Further, following Basu (1983), price to earnings ratio (P/E) ratio has also been considered as an alternative to value risk factor.

Portfolios which are double sorted in terms of ranking of size and value factor have been constructed of the sample companies. On the basis of previous research, MC has been used as a size factor, and P/B & P/E represents a value factor for categorizing the stocks. Every year these portfolios are constructed in the month of June (t).The reason behind selecting the month of June

for the construction of the portfolio is because of P/B & P/E ratio being partly accounting based. In India the accounting based information is available each year in the month of March and there is a possibility that the financial information of some firms may get delayed. This may create a lag between the closing date and the time the market absorbs the information. Therefore, in this study the portfolios have been constructed with a three months gap from the month March, which is the financial closing month of the year.

In the sorting process stocks are classified in two groups, the top 50 percent denoted by Big (B) and the bottom 50 percent denoted by Small (S). Groups are the further categorized into three subgroups on the basis of P/B ratio; bottom 33.33 percent denoted by Low (L), Medium (M) is for 33.33 percent to 66.66 percent and High (H) is for above 66.66 percent. Hence, six portfolios (S/L, S/M, S/H, B/L, B/M and B/H) have been constructed by interconnecting MC and P/B factor.

For example, S/L is a portfolio of small and relatively distressed firms and B/H is a portfolio of big and relatively less distressed firms. From the period July 2007 to June 2008, the equally weighted monthly excess returns for these six portfolios have been computed. The portfolios are again revised in June 2008 and this process of revised portfolio formation is repeated till April 2017. Further, from July 2007 to April 2017 the monthly mean excess returns on each of these portfolios have been computed

In order to measure the risk factor related to the size, a portfolio of small minus big (SMB) has been constructed and is expressed in equation (1),

"SMB = (S/L + S/M + S/H) /3 - (B/L + B/M + B/H) /3 …….....…. (1)"

Further, in order to measure the value risk factor, a portfolio of low minus high (LMH) has been constructed and is expressed in equation (2),

"LMH = (S/L + B/L) / 2 - (S/H + B/H) / 2 ……..
… (2)"

The most popular version of capital asset pricing model (CAPM) shown in equation (3) and it is estimated by regressing the excess returns of the portfolios (S/L, S/M, S/H, B/L, B/M, B/H) on the excess return of the market factor.

$R_p - R_f = a + b*(R_m - R_f) + e_p$……
……..... (3)

Where,
R_p = the returns on the portfolio,
R_f = the risk-free rate of return
$R_m - R_f$= market risk premium,
a = unconditional mean return of the portfolio
b = sensitivity coefficient
e_p = error term of the market model

The equation (4) shows the Fama-French three factor model. It is estimated by regressing excess returns on the constructed portfolios (S/L, S/M, S/H, B/L, B/M, B/H) on the marker risk factor, size risk factor and value risk factor

$R_p - R_f = a + b*(R_m - R_f) + s*SMB + l*LMH + e_p$
……. (4)

Where,

Size risk factor is denoted by SMB, value risk factor is denoted by LMH, s is the regression coefficient and it is sensitivity coefficients of Size risk factor, l is also the regression coefficient and it is sensitivity coefficients of value risk factor. Further, the size risk factors (SMB) and value risk factor (LMH) have been expected to behave orthogonally in the factor model.

Empirical Analysis and Findings

From the Table-1 and 2, it is observed that under both the small and big size groups, the mean excess return follows an increasing pattern from high P/B and P/E to low P/B and P/E. Further, the mean excess return of B/H portfolio is outperformed by the S/L portfolio. From the results it can be seen that there exist a strong inverse relationship between excess return and the size, and a strong positive relation between excess return and the value factor. Hence, the results of the study display a strong evidence of the existence of size and value effect in the Indian capital market. These results are similar to the findings of Fama-French (1992, 1995) on US markets and Connor and Sehgal (2003) on Indian markets. However, the results contradict the findings of Berk (1995) on US markets that show that the size effect is unneeded. Berk (1995) presented in his study that the size-return relationship does not exist for the non-marketable size measures.

Table 1: Portfolios mean excess returns based on MC and P/B sorting

MC-PB	**BH**	**BM**	**BL**	**SH**	**SM**	**SL**
Mean Excess Return	0.52%	0.38%	0.75%	1.02%	1.55%	1.64%

Table 2: Portfolios mean excess returns based on MC and P/B sorting

MC-PE	**BH**	**BM**	**BL**	**SH**	**SM**	**SL**
Mean Excess Return	0.33%	0.67%	0.65%	1.15%	1.37%	1.70%

From the results, one may get an impression that the differential mean excess return between the SL and BH portfolios seems to be too big to be described by marker risk factor. Thus, the next objective is to evaluate the prevalent asset pricing model – CAPM for size and value effect in the excess returns of the securities.Table-3, reports the estimates of CAPM on the constructed portfolios. For CAPM to be the best estimation model for excess returns then the risk adjusted abnormal returns should be close to zero i.e., the "a" (alpha-intercept) in the Table-3, should tends to zero. From the

results of Table-3, it can be seen that the "a" (alpha-intercept) is statistically significant at 5 percent level of significance for almost all the portfolios of small size group in both the cases of MC-P/B and MC-P/E. The magnitude of risk adjusted abnormal return increases further as we move from high P/B to low P/B value-portfolios thereby making it more statistical

significant. Thus, it is reasonably evident that the benchmark model – CAPM fails to absorb the risk adjusted abnormal returns.

Table 3: CAPM for MC and P/B & MC and P/E sorting outcome

MC-PB	a	b	t(a)	Sig t(a)	t(b)	Sig t(b)	R2	Adj R2	F	Sig F
BH	0.2850	0.8052	1.0961	0.2750	21.2372	0.0000	0.7950	0.7940	451.0170	0.0000
BM	0.0824	1.0260	0.2788	0.7810	23.8619	0.0000	0.8308	0.8293	569.3908	0.0000
BL	0.4026	1.1888	1.3159	0.1910	26.6885	0.0000	0.8599	0.8587	712.2745	0.0000
SH	0.7328	0.9948	1.8732	0.0640	17.4657	0.0000	0.7245	0.7221	305.0494	0.0000
SM	1.2360	1.0901	2.9309	0.0041	17.7549	0.0000	0.7310	0.7287	315.2368	0.0000
SL	1.2900	1.2108	2.6757	0.0085	17.2497	0.0000	0.7195	0.7171	297.5532	0.0000
MC-PE	**a**	**b**	**t(a)**	**Sig t(a)**	**t(b)**	**Sig t(b)**	**R2**	**Adj R2**	**F**	**Sig F**
BH	0.0652	0.9153	0.2531	0.8007	24.4045	0.0000	0.8370	0.8356	595.5795	0.0000
BM	0.3889	0.9589	1.6361	0.1045	27.7074	0.0000	0.8687	0.8676	767.7007	0.0000
BL	0.3163	1.1459	1.0022	0.3183	24.9377	0.0000	0.8428	0.8414	621.8910	0.0000
SH	0.8297	1.0954	2.0895	0.0389	18.9454	0.0000	0.7558	0.7536	358.9281	0.0000
SM	1.0729	1.0256	2.6519	0.0091	17.4116	0.0000	0.7233	0.7209	303.1635	0.0000
SL	1.3562	1.1748	2.8625	0.0050	17.0309	0.0000	0.7143	0.7119	290.0513	0.0000

Now, it is important to identify the risk factors. Obtained results are from the Fama-French three factor model are recorded in Table-4. It can be inferred from the results of "a" (alpha-intercept) and adjusted R-square value of (0.93) of S/L portfolio that the Fama-French model captures the major portion of the excess return on S/L portfolio compared to B/H portfolio. The rationale behind such a finding is S/L portfolio is heavily loaded with the size and value factors in contrast to B/H portfolio. Further, from the results of Table-5, it can be observed that Fama-French model superseded the CAPM in terms of explaining the variance of returns.

Table 4: Results of Fama-French model for MC and P/B & MC and P/E sorting

MC-PB	a	b	S	l	Sig t(a)	Sig t(b)	Sig t(s)	Sig t(l)	R2	Adj R2	F	Sig F
BH	0.22	0.92	0.26	-0.46	0.35	0.00	0.00	0.00	0.85	0.85	214.00	0.00
BM	-0.17	1.01	0.31	-0.04	0.58	0.00	0.00	0.70	0.84	0.84	204.08	0.00
BL	0.00	0.98	0.23	0.62	0.99	0.00	0.00	0.00	0.93	0.93	524.38	0.00
SH	-0.18	1.01	1.29	-0.46	0.44	0.00	0.00	0.00	0.91	0.91	381.03	0.00
SM	0.21	0.94	1.19	0.13	0.46	0.00	0.00	0.13	0.90	0.89	325.68	0.00
SL	0.03	0.95	1.33	0.46	0.89	0.00	0.00	0.00	0.93	0.93	537.97	0.00
MC-PE	**a**	**b**	**S**	**l**	**Sig t(a)**	**Sig t(b)**	**Sig t(s)**	**Sig t(l)**	**R2**	**Adj R2**	**F**	**Sig F**
BH	-0.06	0.93	0.27	-0.27	0.82	0.00	0.00	0.01	0.85	0.85	221.69	0.00
BM	0.22	0.94	0.19	0.03	0.38	0.00	0.02	0.76	0.88	0.87	266.89	0.00
BL	-0.22	1.00	0.27	0.79	0.38	0.00	0.00	0.00	0.91	0.91	407.21	0.00
SH	-0.15	1.01	1.29	-0.24	0.52	0.00	0.00	0.01	0.93	0.92	476.24	0.00
SM	0.08	0.90	1.15	0.10	0.77	0.00	0.00	0.34	0.89	0.88	295.55	0.00
SL	0.01	0.95	1.30	0.70	0.97	0.00	0.00	0.00	0.93	0.93	517.36	0.00

Table 5: Comparison of CAPM &Fama-French model

Arithmetic Mean of Adjusted R Square		
	CAPM	**Fama-French**
MC-PB	0.77	0.89
MC-PE	0.79	0.90

One of the issues of multifactor models is the existence of high degree of correlation among the risk factors that give rise to the problem of multicollinearity. From the Table-6 of correlation matrix of risk factors it can be seen that there exist a weak correlation among the risk factors and thus, it supports the premise that the risk factors are expected to be orthogonal in the three factor model and generates the best linear unbiased estimators (BLUE).

Table 6: Correlation matrix of the risk factors

MC-PB	SMB	LMH	$(R_m - R_f)$		MC-PE	SMB	LMH	$(R_m - R_f)$
SMB	1	-	-		SMB	1	-	-
LMH	0.405896	1	-		LMH	0.309912	1	-
$(R_m - R_f)$	0.216813	0.526788	1		$(R_m - R_f)$	0.216813	0.392206	1

Conclusions

The present article evaluates the three factor model proposed by Fama-French in terms of its ability to capture the size and value effect in the Indian capital market. The double sorted portfolios have been constructed on 222 sample companies over a period from January 2007 to April 2017. The formation of portfolios are based on the size (MC) and value (P/B) measures proposed by Fama-French. However, based on the past literature on asset pricing models the study also includes an alternative measure (P/E) for the value factor to test the efficacy of the Fama-French model. The findings of this paper confirm the existence of size and value effect in the Indian capital markets and it is also proved that the Fama-French model is suggested to be a better model than CAPM in terms of capturing the systematic risk. Further, it has been observed that issue of multicollinearity does not exist among the risk factors during the period of study which makes the three factor model more robust. The alternative measure (P/E) for the value factor has been also proved to be an effective measure in capturing the value effect in Indian stock markets. Thus, the study suggested that if the securities are prices efficiently, the risks associated with the stocks are multidimensional.

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