Size and value premiums in the Indian stock market

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Abstract

The poor empirical record of the CAPMpaved the way towards the development of multi-factor asset pricing models. The three-factor model of Famaand French (1993) is regarded as a ground-breaking multi-factor asset pricing model. This paperexamines the performance of the three-factor model of Fama and French (1993) in the Indian stock market for the period 2000-2012 using BSE-500 stocks as sample. The results suggestthe presence of significant size and value premiums in the Indian stock market during the sample period. The three-factor model performs better than the CAPM, as the GRS test is unable to reject it.

Keywords:

Asset pricing, Fama-French three-factor model, multi-factor models, CAPM

JEL Classification: G12

Introduction

In empirical asset pricing, few papers have as much influence as the Fama and French(FF hereafter)model(1993). In their landmark paper, they propose an empirically motivated model for asset pricing which captures the pattern in average returns in the US stock market better than the celebrated and theoretically sound capital asset pricing model (CAPM). Apart from market beta, the Fama-French three-factor model incorporates the size effect (Banz, 1981) and value effect(DeBondt and Thaler, 1985; Lakonishok, Shleifer, and Vishny, 1994;Chan et al., 1991: Basu,1977). These effects were known facts in the stock market.

Many stock market anomalies are explained by the three-factor model.This evidence is seen as a strong case against the CAPM. Despite this, empirical evidence in favor of the three-factor , model is not persuasive enough to accept itas a final and perfect model, asFama and French (2012) state “the model's explanation of average returns is far from complete”. Therefore, the search for a sound model of returns is far from over.

India is a very large emerging country with fast maturing stock market.

The motivation for this study stems from the fact that only few studies have explored the empirical validity of the FF model in the Indian context such asConnor andSehgal (2003),Sehgal and Balakrishnan (2013) and Bahl (2006). Further, emerging markets may exhibit different patterns of returns in contrast to the developed markets, hence it may be interesting to test the model in the Indian setting. In addition, Fama and French (2012) show that regional versions of the asset pricing models provide good description of local average returns for size and value sorted portfolios.Moreover, evidences from emerging markets are considered as out of sample and counter the data snooping and selection bias. We find a significant size and value effect in the Indian stock market. The results are supportive to the FF model and the failure of the CAPM is evident from the results. Rest of the paper is organized as follows: Section 2 contains the literature review with a focus on the Indian studies. Section 3 consists of the methodology followed. Section 4 presents the empirical results and the article ends with the conclusion in section 5.

Brief Review

Poor performance of the CAPM in empirical studies opens the door for multi-factor models. Fama and French (1992) observe that the market beta fails to describe the cross-sectional variation in equity returns and the two variables, size and book-to-market ratio, do a better job in explaining the average returns. Fama and French (1993) incorporate size and value effects as risk factors in their model. According to thismodel the returns are not only dependent upon the covariance of the stock returns with market return, but also upon the covariance with the size and value factors, which are the spreads in the size and value portfolios respectively.

After initial US evidence, Fama and French (1998) document international evidence for sixteen developed and thirteen emerging markets (including India). The Fama-French controversy has created huge stir in the academic world. There is a lot of literature supporting, contradicting, criticizing and extending the Fama-French model.

One of the criticisms leveled against the FF model is that it lacks a sound theoretical base.Zhang (2005) provides a theoretical justification to the value premium, citing costly reversibility and countercyclical price of risk as explanation of value premium. Fama and French (1998) find “relative distress” associated with the value firms. Apart from these rational explanations, DeBondt and Thaler (1985) and Lakonishok et al. (1994) provide behavioral explanation of the value premium as irrational overreaction.Daniel and Titman (1997) argue that it is the characteristics of stocks rather than the covariance, which determines the stock returns**.**In spite of these qualifications, FF model enjoys a widespread acceptability as it is now a common practice to report an anomaly after adjusting for the FF factors. Moreover, it acts as a benchmark model for assessing the performance of fund managers.

Tests of Fama-French Model in the Indian Stock Market

Similar to other markets, CAPM has failed to stand to empirical tests in the Indian stock market too (see Ansari, 2000), leading to empirical testing of alternative models such as FF model. However, there are only few studies that explorethe FF model in the Indian context.Fama and French (1998) consider Indian stock market in their comprehensive study of 29 markets. Their data is from International Finance Corporation(IFC) and the sample period is 1987-1995. Interestingly, they report HML and SMB of the negative sign, albeit insignificant. In other words the size and value effects were non-existent in their sample. The focus in their study is however, not testing the three-factor model but showing the value premium in international markets. They conclude that when the CAPM is augmented with a value factor, it captures the return pattern better. Connor and Sehgal (2003) is the first study to test the FF model specifically for the Indian stock market. They report 1.2 per cent SMB(size factor) and 0.03 per cent HML (value factor) per month for the period 1989-1999 using 264 stocks data. The GRS test rejects the null hypothesis of joint significant of intercepts for the CAPM and validatesthe FF model. On the whole, their evidence is supportive of the FF model.Using BSE-500 companies,Sehgal and Balakrishnan (2013)confirm the size and value effects in India for the period 1996 to 2010. They also explore the alternative versions to form and test the three factor model,like market capitalization, total assets and enterprise value for size proxy and P/B, P/E and past sales growth as the proxy for distress risk and find that the central findings are insensitive to alternative formations. Taneja(2010)reports a very high correlation between SMB and HML factorsand concludes that either of the two factors improve the performance of the CAPM. Interestingly, the sign of both the SMB and HML is negative, contrary to the prediction of the FF model. This finding could be sample specific as the sample is too short, 2004-2009and 187 stocks. There is a high possibility of overrepresentation of large capitalization stock in his sample.Bahl (2006) provides evidence for 2001-2006 using BSE-100 stocks. She is unable to reject either of the two, CAPM and FF on the basis of GRS. The time durations of the later two studies are too short. In general studies focusing on India find supportive evidence in favor of the three-factor model. We revisit to examine the three-factor model's performance in Indian stock returns for the period 2000-2012 taking BSE-500 companies as sample. We hope that the results would make the picture clearer on the performance of the FF model in the Indian stock market.

Data and Methodology

Our stock returns and accounting data is from Prowess, a database maintained by Center for monitoring Indian economy (CMIE). The sample period is from April, 2000 to March, 2012. Sample companies form the basis of BSE-500, a broad based index which accounts for more than 90 percent of the market capitalization and trading volume. Rest of the market is thinly traded. Some data is missing for market capitalization or B/M ratio so the average number of stocks used to form portfolios is 384(minimum 296 in 2000 and maximum 496 in 2011). Implied yield on 91 days Treasury bill is the surrogate for risk free rate taken from RBI website. Return on BSE Sensex is taken asa proxy for market return.

The empirical form of the three-factorFama and French (1993) model is:

$$R_i(t) - RF(t) = \alpha_i + b_i\left[RM(t) - RF(t)\right] + s_i\,SMB(t) + h_i\,HML(t) + \varepsilon_i(t). \quad (1)$$

In this regression, *Ri (t)* is the return on asset *i*for month *t. RF (t)* is the risk free rate. *RM (t)* is the return on broad portfolio of market. *SMB (t)* is the difference between the diversified portfolios of small and big stocks and *HML (t)* is the difference between the diversified portfolios of value and growth stocks.

$$SMB = \frac{SG + SN + SV}{3} - \frac{BG + BN + BV}{3}$$

$$HML = \frac{SV + BV}{2} - \frac{SG + BG}{2}$$

β, *s* and *h* are the sensitivity coefficients related with the market return, SMB and HML respectively. α is the intercept. ε is the error term. SMB and HML are meant to mimic the risk factors related to size and value respectively. The inputs for this regression are constructed similar to Fama and French (1993).The methodology proposed by Fama and French (1993) to construct the risk factors is a counterpart of Fama and Macbeth (1973) cross-sectional test. Both approaches are now standard in asset pricing literature. Former can be used only when the risk factors are returns and later can be used on almost everything.

As in Fama and French (1993), we do a 2×3 sort to construct six portfolios. In June of each year,we sort stocks on the basis of market capitalization and split it into small and big by the median. We again sort the small and big portfolios into three groups by their ranked book-to-market ratio at the end of previous financial year (March). The breakpoint for value is 30^{th} and 70^{th} percentiles. This double sorting thus produces six portfolios namely, SG, SN, SV, BG, BN and BV. (S for small, B for big, G for growth, N for neutral and V for value). We calculate equal-weighted returns for these portfolios for the next twelve months. Portfolios are re-constructed in June of each year. The difference between the simple average returns of the three small (SG, SN and SV) and the three big (BG, BN, and BV) portfolios is *SMB* (small minus big) and the difference between the simple average of two value (SV and BV) and two growth (SG and BG) portfolios constitutes the *HML* (high minus low) and thus is neutral with respect to size. Our LHS portfolios are same six portfolios, as a 5×5 sort may stretch our data too much.

We estimate the coefficients of equation (1) using Ordinary Least Square (OLS) regressions with Heteroskedasticity and autocorrelation consistent (HAC)Newey-West standard errors. If a model is a better descriptor of the stock return patterns then the intercept term α in the equation (1) should be indistinguishable from zero, as α signifies the pricing error. For a joint test of significance of intercepts, Gibbons, Ross and Shanken (1989) propose a statistics which tests the joint significance of all intercepts, $\alpha_i=0\,\forall_i$. The GRS test is a test of the efficiency of the RHS portfolio/s. It's a test that some linear combination of RHS factor portfolios is on the ex-post efficient frontier. Along with t tests of the intercepts we also report the GRS statistics for the model.

Empirical Results

Table 1 presents the summary statistics for the 2×3size-*B/M*portfolios and factor returns.The sample is BSE-500 stocks from April, 2000 to March, 2012. The pattern is similar to what is reported in other markets. Specifically, the monthly return on small stocks is higher than the returns on big stocks. The average spread in the returns of small and big stocks is 1.82 per cent per month which is significant bothstatistically and economically. There is an obvious relation between size and average return. The relation between average return and *B/M* is consistent in Table 1. In both size groups, the return increases with *B/M* monotonically. Highest return is on small value portfolio, as perceived, with 4.5 per cent per month. Returns on big growth stocks are lowest with 0.77 per cent per month. The spread in the value portfolios is 1.82 per cent and 2.03 per cent in small and big stocks portfolios respectively. The average return on factor portfolios*SMB and HML* are 1.82 per cent per month and 1.92 per cent per month respectively. The standard deviation of the *SMB* and *HML* returns is 3.7 per cent and 4.8 per cent per month respectively. Average market return is 1.22 per cent per month and risk free rate averages to 0.52 per cent per month, thus average excess market return is 0.70 per cent per month. All variables are significantly different from zero except the portfolio returns of BG and market premium (*Mkt-Rf*). The *t* statistics for risk-free rate is unusually high as there is little variation in it.

Table 2 shows the correlation matrix for each set of factors. Excess market return is positively relatedwith *SMB* and *HML*, and the correlation is a bit stronger for *HML*. The correlation between excess market return and *SMB* is close to zero 0.02, and the correlation between excess market return and HML is very low at 0.17. SMB is moderately related with HML at 0.24. The low correlation of SMB and HML is a good news for a model, as factors need not be highly correlated with each other. The low correlation of SMB and HML with the market return is in conformity with the previous findings.

We consider four different models: (i) CAPM, in which R_m-R_f is the only RHS variable, (ii) excess market return with *SMB* factor, (iii) excess market return with *HML* factor and (iv) three-factor model of Fama and French (1993). An ideal model's regression intercepts should be zero for all the test portfolios. GRS statistic which tests the hypothesis $\alpha_i = 0 \forall_i$ should not be significant for an ideal model. Table 3 shows the parameters and their t-values for the four models. It also reports the GRS statistic and its corresponding p valuesof the f test. GRS test rejects all the models except the FF**.** We could not reject the FF model with a p value of GRS statistic of 0.07. In two cases the p value is less than 0.01 and in once case it is 0.02.

Average model fit when only market excess return is regressed on portfolio returns is 65 per cent. Market beta is highly significant and the intercept is significant in four out of six portfolios indicating the missing risk factors and failure of the CAPM to explain the stock returns. When either *SMB* or *HML* is used along with the excess market return the adjusted R^2 increases to a modest 74 per cent and 71 per centlevels respectively. In the case of market and *SMB*, only in one out of six cases the model is rejected and in the case of market and *HML* the model is rejected in three instances out of six on the basis of the intercept. Finally when all the three factors are regressed to examine the returns of six portfolios, we are unable to reject the model, as all intercepts are insignificantly negative. As far as R^2 is concerned, is goes up to 79 per cent. The three-factors jointly explain 79 per cent percent of the variations in average returns over time.

Table 4 summarizes the performances of all the models. The GRS rejection is stronger when only excess market is used as an explanatory variable. The rejection does not necessarily mean that the model is bad as pointed out by Roll (1977).It may alternatively mean that the market portfolio does not lie on the efficient frontier.The p-value of GRS statistic of FF model is 0.07. Similar to Connor and Sehgal (2003), the GRS is unable to reject the FF model at a significance level of 5 percent. On the criteria of mean absolute alpha, three-factor model is best with the lowest average absolute alpha. Average R^2 is highest at 79 per cent for the FF model. The standard error of regression is also lowest for the FF model.R^2 of the FF model is comparable with the studies on India; however, it is below the Fama and French (1993) average R^2, which is in the range of 90-95.

Table 5 reports the market, size and value premia. We calculate the premium by multiplying the mean factor return by the coefficient loading of the model. For example the market premium for portfolio SG will be, mean excess market return multiplied by the market beta i.e. 0.70×1.084=0.75 per cent. We expect that the size premium, for example, will be higher for the portfolio of small stocks and lower for the portfolio of big stocks. Market premium is consistent for all the test portfolios. Size premium is high for small stocks and low for big stocks as expected. It is highest for small neutral (SN) portfolio at 2.09 per cent per month. The pattern of value premium is more consistent. The value premium is high for the value stocks and negative for the growth stocks in both the small and big stock groups. Table 6 shows the CAPM and FF alphas for the two sub-periods (2002-2006 and 2006-2012). The alphas of CAPM are larger than the FF alphas in the first sub-period, but in the second sub-period average absolute alphas are equal.

Conclusion

Similar to developed markets, Indian stock market alsoexhibits the size and value effects. Return on small stocks is higher than the return on big stocks and value stocks have high return compared to growth stocks. The spreads in the size and value portfolios are 1.82 per cent and 1.92 per cent per month, whichare statistically and economically significant. The null hypothesis of jointsignificant of intercepts is rejected for the CAPM but could not be rejected for the FF model. Moreover, on the basis of average absolute alpha and average $R^2$the FF model fares better. The bottom line is that three-factor model performs better than the CAPMin explaining the cross-section of stock returns in the Indian stock market. However, the results may be sensitive to other variables reported to explainthe cross-section of stock returns like momentum (Jegadeesh and Titman, 1993), skewness(Harvey and Siddique, 2000) and illiquidity (Amihud, 1986) etc.It would be interesting to explore the effects of these variables on the FF model. Further, the question of covariance or the characteristics (Daniel and Titman, 1997) as the driver of returns remain unanswered.

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Table 1. Summary statistics of the portfolio returns
(BSE500 stocks from July 2000 to March 2012, 141 Observations)

	Mean	SD	Skewness	Kurtosis	*t* value
SG	2.73[a]	10.3	0.495	7.85	3.14
SN	3.38[a]	11.0	0.584	5.56	3.65
SV	4.55[a]	11.7	0.133	3.99	4.61
BG	0.77	8.3	0.094	7.54	1.09
BN	1.47[c]	9.7	0.291	6.93	1.79
BV	2.80[a]	10.9	0.451	5.12	3.02
SMB	1.82[a]	3.7	0.779	4.31	5.72
HML	1.92[a]	4.8	1.50	7.88	4.70
MKT	1.22[c]	7.6	-0.177	3.87	1.88
Rf	0.52[a]	0.13	0.118	2.29	45.33
Mkt-Rf	0.70	0.07	-0.17	0.97	1.07

Superscript a,b and c denote significance level at 1%, 5% and 10%.

Table 2. Correlations

	Mkt-rf	SMB	HML
Mkt-rf	1		
SMB	0.024	1	
HML	0.176	0.249	1

Table 3. Regressions of size and book-to-market sorted portfolio excess returns (R_i) on combinations of the market (MKT), size (*SMB*) and value (*HML*) factor portfolios.HAC (Newey-West) adjustedt values are given in parenthesis. GRS F-test p values are given in parenthesis.

Explanatory variables	Portfolios excess returns	a	b	s	h	R^2
MKT	SG	0.014(2.51)	1.076(9.80)			0.643
	SN	0.021(2.79)	0.987(9.07)			0.474
	SV	0.032(4.44)	1.117(10.52)			0.536
	BG	-0.004(-1.30)	0.977(12.88)			0.802
	BN	0.001(0.35)	1.146(15.27)			0.820
	BV	0.015(2.37)	1.139(14.67)			0.637
	GRS	7.85(<0.01)				
MKT and *SMB*	SG	-0.005(-1.15)	1.065(10.13)	1.097(11.33)		0.803
	SN	-0.000(-0.10)	0.975(9.11)	1.237(12.26)		0.653
	SV	0.006(1.26)	1.102(13.33)	1.425(8.70)		0.745
	BG	-0.007(-2.07)	0.975(12.74)	0.171(2.31)		0.807
	BN	-0.003(-0.97)	1.143(15.16)	0.281(4.12)		0.831
	BV	0.006(0.94)	1.134(14.82)	0.485(2.53)		0.663
	GRS	2.58 (0.02)				
MKT and *HML*	SG	0.0136(2.15)	1.073(9.30)		0.04(0.48)	0.640
	SN	0.0143(1.93)	0.952(8.19)		0.401(3.04)	0.506
	SV	0.0129(2.12)	1.011(9.31)		1.055(6.90)	0.726
	BG	-0.0031(-0.97)	0.985(12.42)		-0.060(-0.87)	0.802
	BN	-0.0005(-0.131)	1.140(14.04)		0.108(1.34)	0.825
	BV	-0.0025(-0.49)	1.047(10.78)		0.934(5.95)	0.809
	GRS	3.99(<0.01)				
MKT, *SMB* and *HML*	SG	-0.003(-0.63)	1.084(10.06)	1.153(10.22)	-0.177(-1.44)	0.807
	SN	-0.002(-0.47)	0.964(8.48)	1.179(11.77)	0.168(1.43)	0.658
	SV	-0.003(-0.98)	1.023(10.80)	1.157(7.35)	0.826(10.38)	0.856
	BG	-0.006(-1.76)	0.987(12.46)	0.204(2.62)	-0.100(-1.40)	0.808
	BN	-0.004(-1.00)	1.143(14.14)	0.254(3.43)	0.057(0.75)	0.833
	BV	-0.005(-1.09)	1.049(10.65)	0.200(1.25)	0.894(4.91)	0.813
	GRS	1.94(0.07)				

Table 4. **Summary of regression intercepts for 6 *Size-B/M* portfolios**

	GRS	p-value	Ave. |α|	Ave. R^2	Ave. SE (α)
CAPM	7.85	<0.01	0.014	0.65	0.06
CAPM and *SMB*	2.58	0.02	0.045	0.74	0.05
CAPM and HML	3.99	<0.01	0.007	0.71	0.05
FF	1.94	0.07	0.003	0.79	0.04

Table 5. **Market, Size and Value Premium**

Portfolio	Market premium (%)	Size Premium (%)	Value premium (%)
SG	0.75% (10.06)	2.09% (10.22)	-0.33% (-1.44)
SN	0.67% (8.48)	2.14% (11.77)	0.32% (1.43)
SV	0.71% (10.80)	1.49% (7.35)	1.58% (10.38)
BG	0.69% (12.46)	0.37% (2.62)	-0.19% (-1.4)
BN	0.80% (14.14)	0.46% (3.43)	0.10% (0.75)
BV	0.73% (10.65)	0.36% (1.25)	1.71% (4.91)

t statistics of corresponding coefficient is given in parenthesis.

Table 6. **CAPM and Three Factor Alphas in Sub periods**

	5/2000 to 03/2006		03/2006 to 03/2012	
Portfolio	CAPM	FF	CAPM	FF
SG	0.026 (3.21)	0.002 (0.32)	0.003 (0.54)	-0.006 (-1.12)
SN	0.039 (3.16)	0.007 (0.63)	0.005 (0.94)	-0.008 (-1.58)
SV	0.054 (5.08)	-0.002 (-0.30)	0.012 (2.19)	-0.004 (-1.09)
BG	-0.002 (-0.59)	-0.007 (-1.41)	-0.004 (-1.05)	-0.004 (-1.11)
BN	0.008 (1.75)	0.000 (0.05)	-0.005 (-1.21)	-0.007 (-1.58)
BV	0.029 (2.90)	-0.002 (-0.33)	0.002 (0.40)	-0.006 (-1.15)
Av. |α	0.026	0.003	0.005	0.005

t statistics of the intercepts is given in parenthesis.