COMMON FACTORS IN STOCK RETURNS: THE INDIAN EVIDENCE

Abstract

The study attempts to evaluate if there are any systematic patterns in stock returns for the Indian market. The empirical findings reveal that there is a reversal in long-term returns, once the short-term momentum effects has been controlled by maintaining a one year gap between portfolio formation period and the portfolio holding period. A contrarian strategy based on long-term past returns provides moderately positive returns. Further, there is a continuation in short-term returns and a momentum strategy based on its provides significantly positive payoffs. The results in general are in confirmity with those for developed capital markets such as US.

1. INTRODUCTION

Fama and French (1993) propose a three-factor model that captures much of the variation in the stock returns for the US market, that are missed by one-factor capital asset pricing model (CAPM).[1] the three explanatory factors of the Fama-French model are the market factor and two mimicking portfolios relating to size (SMB) and book to equity to market equity (HML) factors in returns.

Specifically, the expected return on a portfolio is

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

Where

$R_M - R_F$, SMB and HML are expected returns, and the factor sensitivities (or loadings) b, s and h are the slopes on the time-series regression.

There is now considerable evidence from other world markets in support of the three-factor model. [See Chan, Hanao and Lakonishok (1991), Capasul, Rowley and Sharpe (1993), Fama and French (1998) Chui and Wei (1998)]. However, much of the empirical support is limited to develop capital markets. Kothari, Shanken and Sloan (1995) assert that any rational asset pricing model must be tested to work under a variety of conditions and not for a limited set of portfolios. Hence, there is a need for more out-of-sample tests, especially relating to emerging markets. It is commonly observed that emerging market returns have unusual features.[2] [Harvey 1995)]. Hence, they pose a greater challenge to the universal applicability to a rational asset pricing theory.

In this paper, we test the three-factor asset pricing model for India, on emerging market. Our results suggest that the three-factor model provides a better description of the cross-section of stock returns compared to one-factor CAPM. We further find that size and BE/ME factors are not a seasonality phenomenon, i.e., they are not on outcome of any month-of-the-year effects.

The paper comprises of five sections including the present one. In Section 2 we describe data and their sources. In Section 3, we evaluate if there are common factors in returns. In the next Section, we verify if size and BE/ME are caused by any seasonality effects. Section 5 contains summary and concluding remarks.

2. DATA

The data comprises of month-end adjusted share prices for 364 companies from June, 1989 to March,1999. The sample companies form part of CRISIL-500, a broad-based stock market index that covers 97 industries and gives representation to companies of varying levels of size and trading activity. The sample companies account for a major portion of market capitalization and average trading volume in India, and hence are fairly representative of market performance. Moreover, bulk of the out-of-sample companies are either very thinly traded or do not provide a long and continuous track-record of financial and accounting information. Their inclusion would have posed serious estimation problems.

The share price data has been obtained from Capital Market Line, a leading financial software. The data source, however, provides unadjusted share prices. The raw data has been adjusted for capitalization changes such as bonus, rights and stock splits to make the price series comparative over time. The share price series have been used to construct monthly return series. Only capital gains component has however been used in estimating returns, as the dividend information for the sample companies is not available with us. However, ignoring dividends should not pose a serious estimation bias (as we shall see in the next section) in light of the fact that Indian companies exhibit very low dividend yield ratios over the sample period [See Gupta L.C. (2000)], thereby implying that they use the free cash flow for the re-investing or for acquisition purpose. Further, the market index, that is used on explanatory factor in the study, does not incorporate dividends. Hence, including dividends while estimating stock returns would have actually introduced a positive bias in the slope estimates of our time-series regressions.

The Bombay Stock Exchange (BSE) National Index has been used as a surrogate for aggregate economic wealth. The BSE National Index is a broad-based and value-weighted stock market proxy, constructed on the lines of standard & Poor, USA. The implicit yields on 91-day treasury bills (T-bills) have been used as risk-free proxy, as is the common practice in investment management research. The data source is Report on Currency and Finance, an annual publication of the Reserve Bank of India.

The accounting information has been obtained for the sample companies from 1988 to 1998. The accounting values are taken for March-end each year, which is the financial closing month in India. The data source is CMIE Provis a financial software that is extensively used by academic researchers as well as practitioners.

3. COMMON FACTORS IN RETURNS

3.1 The Dependent Portfolios

In June of each year t, from 1990 to 1998, all the sample stocks are ranked on the basis of size (price times share also termed as market capitalization). The median sample size is then used to split the sample companies into two groups: small (s) and big (B).

We next break the sample stocks into three BE/ME groups based on the breakpoints for the bottom 30% (low), middle 40% (medium) and top 30% (high) of the ranked values of BE/ME for the sample companies. BE/ME has been estimated as book value per share in March of year t-1 times the market value per share is March of t-1.

We then estimate six portfolios (S/L, S/M, S/H, B/L, B/M and B/H) from the inter-section of two size and three BE/ME groups. S/L contains stocks of small and low BE/ME companies, while B/H represents big companies with high BE/ME ratios. Monthly equally-weighted returns on the six portfolios are calculated from July of year t to June of year t+1, and the portfolios are reformed in June of t+1. The return estimation is done from July of year t to ensure that book equity for year t-1 is known to the investors by that time for decision-making purposes. The six size-BE/ME portfolios have been consciously constructed to be equally-weighted as suggested by Lakonnishok, Shliefier and Vishny (1994), since they contain less estimation errors compared to value weighted portfolios. Fama and French (1996) document that the three-factor model does a better job in explaining LSV equally-weighted portfolios than the FF value-weighted portfolios.

3.2 The Explanatory Factors

The Fama-French model involves the use of three factors for explaining common stock returns: the market factor ($R_M - R_F$) proposed by Sharpe-Lintner CAPM and two factors relating to size (SMB) and relative distress (HML). Given the market factor, we next construct the SMB and HML factors.

SMB (Small minus Big) is meant to mimic risk factors in returns related to size. SMB is the difference, each month, between the simple average of the returns on three small stock portfolios (S/L, S/M and S/H) and the average of the returns on three large stock portfolios (B/L, B/M and B/H). It is the difference between the returns on small and big stock portfolios with about the same weighted average BE/ME. Hence, SMB is largely free of BE/ME effect, and focuses on the different behaviour of small and big stocks.

HML (High Minus Low) is meant to mimic relative distress factor (also termed as value factor) in returns related to BE/ME. HML is the difference each month, between the simple average of the returns on two high BE/ME

portfolios (S/H and B/H) and the average of the returns on two low BE/ME portfolios (S/L and B/L). It is the difference in returns between high BE/ME and low BE/ME stocks, with about the same weighted average size. HML is largely free of size effect, and focuses on different behaviour of value and growth stocks.

3.3 Background Observations

Table I shows the mean monthly excess returns on the size – BE/ME sorted portfolios and the three Fama-French factors. The six size-BE/ME portfolios exhibit an excess return ranging from .37% to 2.14% per month. The portfolio returns confirm the Fama (1993, 1995) evidence that there is a negative relation between size and average return. More interestingly, the relation between BE/ME and average return is positive, as theoretically expected, for small stock portfolios, while it becomes negative for big stock portfolios. Hence, the Indian equity market seems to exhibit a strong size effect and a conditional value effect. This contrasts with Fama-French (1995) bindings where they show a strong value effect and a conditional size effect for US data.

Our time-series regressions attempt to explain the cross-section of average returns with the premiums for common risk factors in returns. The average risk premiums are just the average values for the explanatory variables. The average value of $R_M - R_M - R_F$ (average premium per unit of market beta) is 0.88% per month. The annual excess return of about 10, 56% is low from investors' perspective compared to the risks posed by emerging markets such as India, as shown by the annual standard deviation of returns that stands at about 45%. The average SMB premium (the average premium for the size related factor in returns) is 1.23% per month is more than four standard errors from 0. The size premium is about ------ times the market premium, where as its' standard deviation is only one-third than that for the market factor. The large mean and low variability of SMB premium suggests an arbitrage opportunity. We however reserve our comments till the results for the three-factor model have been analysed. The book to market (HML) factor is however extremely small (.02% per month). This can be clearly attributed to the negative relationship between BE/ME and average return for the big stocks which almost offsets the value premiums generated by small stocks.

Table II provides the Pearson's correlation coefficients between the explanatory returns. The low correlation between Market and SMB and Market and HML is desirable as the explanatory portfolios should be orthoginal in a multi-factor pricing framework. The correlation between SMB and HML however suggests some over-lapping amongst the two factors.

3.4 Common Variations in Returns

In the time-series regression, the slope and adjusted R^2 (R^{-2}) show whether different risk factors capture variations in stock returns. The role of common factors in returns has been explored in five steps: (a) regressions that use only the market factor ($R_M - R_F$) as explanatory variable (Sharpe-Lintner CAPM) (b) regressions that use SMB and HML as explanatory factors. (c) regressions that use market and SMB factors (d) regressions that use market and HML factors and (e) regressions that use market, SMB and HML factors (the Fama-French model).

The Market – Table III shows that the market factor does explain a fair proportion of the common variations in stock returns. All the beta (b) values are more than 15 standard errors from 0. The R^2 values range from .68 to .83 for the sample portfolios. Not surprisingly, the R^{-2} values are relatively lower for small stock portfolios as well as the B/H portfolio showing the failure of standard CAPM in explaining the size and value effects in returns.

SBM and HML – Table IV shows the power of size and value factors in stock returns. The SMB slopes are much steeper and also statistically significant at 5% level, for the small stock portfolios. The h-values (HML slopes) also climb steeply as one moves from low BE/ME to high BE/ME portfolios. Thus, in the absence of competition from the market factor, the SMB and HML do capture some of the common variations in stock returns. This is again demonstrated by the fact that the R^2 values for S/H and B/H portfolios are about .20 and .22 respectively.

Market and SMB – Table V shows that the market and SMB factors capture a greater proportion of common variations in returns compared to one-factor CAPM, while all the market slopes are more than standard errors from 0, the size slopes are statistically significant at 5% level for small stock portfolios. The improved R^{-2} values for the small stock portfolios also confirm that the size factor contributes noticeably towards the explanation of their returns.

Market and HML – Table VI demonstrates the presence of value factor in stock returns. While market slopes continue to be statistically significant at 5% level, the HML slopes become steeper and R^{-2} values improve for more distressed portfolios (medium and high BE/ME portfolios).

Market, SMB and HML – Table VII shows that the three-factor model provides the best description of stock returns. While all the market slopes are more than 19 standard errors from 0, the SMB slopes are highly statistically significant for small stock portfolios. The HML slopes become steeper as one moves from low BE/ME to high BE/ME portfolios. The R^{-2} values improve appreciably for small stock portfolios as well as the B/H portfolio. While mean R^{-2} is .74 for the one-factor model (Table III), it increases to .84 for the three-factor model (Table VII).

3.5 The Cross-Section of Average Stock Returns

The regression results in Table III-VII suggest that market, SMB and HML proxy for common risk factors in returns. We next verify if the proxy risk factors explain the cross-section average returns on stocks. The average return tests focus on intercepts of time-series regressions. If the explanatory returns are suitable proxies for underlying common risk factors, the intercepts of the time series regressions of excess returns on the mimicking portfolios should not be significantly different from 0. Table VIII lays out the intercept results for regressions in Table III-VII. While the intercepts of regressions (b), (c) and (d) (relating to Tables IV to VI) are important, the intercepts of regressions (a) and (e) are of greater interest as they pertain to the one-factor CAPM and the three-factor CAPM respectively. Using the one-factor model, the intercept values are high for small stock portfolios. They are statistically significant for S/M at S/H and 5% level, while S/L intercepts are also distinguishable from 0 at 10% level. The sample intercepts however sober down and none of them is statistically significant in the three-factor model framework. The mean absolute alpha declines by about 3.5 times from .0076 for one-factor model to .0022 for the Fama-French model. These intercept tests confirm that the three-factor model does capture most of the variations in stock returns, that is missed by standard CAPM.

It is however possible that a part or most of the size effect and value effect may have been caused by a seasonality pattern in stock returns. Keim (1983) documents that stock returns, especially returns in small stocks tend to be higher in January. More recently, Chui and Wei (1998) demonstrate January effect for several Pacific-basin capital markets. It is therefore standard in the tests of asset pricing to look for seasonality effects.

4. SEASONALITY FACTOR IN STOCK RETURNS

The seasonality effect has been examined in two steps:

(a) April Effect – As stated earlier, the financial year closing month in India is March each year. Hence, according to the tax-loss selling hypothesis[3] [Keim (1983)] investors should sell loss-making stocks, generally representing small and distressed firms, in March-end and re-position their portfolios by buying these losers in April. The April effect in India is analogous to the January effect for US market.

(b) January Effect – This may be attributed to the globalisation of the Indian economy over the last decade. The rapid expansion of the new economy (high tech) sector has built strong linkages between Indian economy and rest of the world. Several Indian companies have got listed on NASDAQ, US high-tech stock exchange, making the Indian stock market indices closely paged with the movement in NASDAQ. Further, Foreign Institutional Investors (FIIs), who are playing an increasingly important role in the Indian stock market, follow a December financial closing. However,

we do not expect a pronounced January effect in Indian market in light of the fact that globalisation is a recent phenomenon and the FII investment in India is not as heavy as is the case with some other emerging markets.

The seasonality factor has been tested using the regression

$$R_{Pt} = a + b\,T_t + e_t \qquad (2)$$

Where

R_{P5} are the dependents as well as explanatory portfolios
T is a dummy factor
= 1 in seasonality month
= 0 in non-seasonality months

The regression intercepts are average returns for non-seasonality months and slopes on the dummy factor measure the difference between average returns on seasonality months and average returns on other months (non-seasonality months).

Running the regression (2) for the risk factors will help in understanding whether any positive seasonality effects in explained portfolios are driven by similar effects for explanatory variables.

Table IX provides the results relating to the April effect. The findings negate the presence of any April effect in our explained and explanatory portfolios. The average returns for non-April months (shown by regression intercepts) are large for small stock portfolios. But the average returns for the non-April months is also high for the size (SMB) factor matching the patterns in returns for small stock portfolios.

Table X also confirms the absence of any significant January effect in the explained and explanatory portfolios. Again the high average returns for the non-January months for small stock portfolios are matched by a similar pattern in returns for the SMB factor.

The absence of any seasonality effects in stock returns provides additional support for the three-factor asset pricing model. The size and BE/ME do not appear to be an outcome of any seasonality patterns. Instead, they seem to mimic risk factors associated with some unobservable state variables consistent with Merton's (1973) Inter temporal CAPM or Ross's (1976) Arbitrage Pricing Theory.

5. SUMMARY AND CONCLUSIONS

The study finds that there are market size and book to market equity factors in stock returns. Hence, the three-factor asset pricing model provides a better description of average stock returns for the Indian market as compared to one-factor CAPM.

The out-of-sample evidence, especially for an emerging market, provides strong support to the Fama-French model and suggests that the size and BE/ME factors are pervasive and probably proxy for common risk factors in returns that are of special hedging concern to investors in general. Hence, there is a case for using the three-factor model for market applications such as asset pricing, evaluating portfolio performance, addressing micro-structure issues, corporate valuation, estimating the cost of capital and assessing stock market efficiency. [For applications of the three-factor model see Reinginum (1990), Fama-French (1994), Carhart (1994)].

Notes

1. The standard one-factor CAPM has been developed by Sharpe (1964), Lintner (1965) and Black (1972).

2. Emerging markets differ from developed markets as they are expected to exhibit lower levels of market efficiency, a less evolved institutional and regulatory framework and less mature investor behaviour. Their economic parameters are relatively unstable, and hence less predictable, and their stock markets are fairly volatile.

3. Keim (1983) suggests a tax-loss selling hypothesis to explain size and value effects in US market. According to him investors sell loss-making stocks of small and weak firms in December (financial closing in US) to take advantage of tax-shield. The selling pressure depresses the prices on these stocks. The investors re-position themselves in January on the presumption that excess selling pressure has left them undervalued. The consequent buying pressure increase the prices on these stocks resulting in a positive kink in returns of small and weak stocks in January, commonly termed as the turn-of-the-year effect.

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Table I
Summary Statistics for Explained and Explanatory Returns

Portfolio	Mean	Standard Deviation	T (mean)
S/L	.0155	.1031	1.63
S/M	.0210	.0967	2.36
S/H	.0214	.1093	2.12
B/L	.0091	.0960	1.02
B/M	.0082	.0975	.91
B/H	.0037	.1128	.36
R_M-R_F	.0089	.1159	.824
SMB	.0123	.0326	4.10
HML	.0002	.0453	.05

Table II
Pearson's Correlation on Coefficient between Market, SMB and HML Factors

	Market	SMB	HML
Market	-	-.135	.160
SMB	-	-	-.277
HML	-	-	-

Table III
Excess Portfolio Returns Regressed on Excess Returns for the Market Factor

$$R_M\text{-}R_{Ft}\, a + b(R_{Mt}\text{-}R_{Ft}) + e_t$$

Portfolio	b	t(b)	R^2
S/L	.743	16.215	.695
S/M	.688	15.568	.677
S/H	.794	16.688	.707
B/L	.752	23.106	.823
B/M	.768	23.910	.832
B/H	.831	17.470	.726

Table IV

Excess Portfolio Returns Regressed on Mimicking Returns for Size (SMB) and book to market equity (HML) Factors

$$R_M - R_{Ft} = a + s\,SMB_t + h\,HML_t + e_t$$

Portfolio	s	h	t(s)	t(h)	R^{-2}
S/L	.789	.156	2.630	.726	.041
S/M	.804	.555	2.933	2.818	.086
S/H	.837	1.094	2.868	5.224	.191
B/L	-.131	.109	-.457	.528	-.012
B/M	-.261	.526	-.930	2.615	.063
B/H	-.179	1.171	-.607	5.525	.224

Table V

Excess Portfolio Returns Regressed on Excess Returns for the Market Factor and Mimicking Returns for the Size (SMB) Factors

$$R_M - R_{Ft} = a + b\,(R_M - R_{Ft})\,s\,SMB_t + e_t$$

Portfolio	b	s	t(b)	t(s)	R^{-2}
S/L	.787	1.118	21.922	8.749	.816
S/M	.725	.950	19.524	7.183	.776
S/H	.827	.825	19.184	5.375	.765
B/L	.760	.205	23.334	1.756	.826
B/M	.765	-.084	23.528	-.729	.832
B/H	.822	-.223	17.172	-1.308	.727

Table VI

Excess Portfolio Returns Regressed on Excess Returns for the Market Factor and Mimicking Returns for the Book to Market Equity (HML) Factors

$$R_M - R_{Ft} = a + b\,(R_M - R_{Ft}) + h\,HML_t + e_t$$

Portfolio	b	h	t(b)	t(h)	R^{-2}
S/L	.763	-.313	16.789	-2.709	.771
S/M	.681	.116	15.206	1.015	.677
S/H	.756	.618	17.664	5.648	.769
B/L	.763	-.178	23.510	-2.147	.828
B/M	.752	.270	24.18	3.888	.846
B/H	.775	.889	21.723	9.741	.850

Table VII

Excess Portfolio Returns Regressed on Excess Returns for the Market Factor and Mimicking Returns for the Size (SMB) and Book to Market Equity (HML) Factors

$$R_M - R_{Ft} = a + b\,(R_M - R_{Ft}) + s\,SMB_t + h\,HML_t + e_t$$

Portfolio	b	s	H	t(b)	t(s)	t(h)	R^{-2}
S/L	.792	1.078	-.111	21.925	8.157	-.165	.817
S/M	.710	1.064	.316	19.786	8.109	3.339	.795
S/H	.786	1.124	.829	24.602	9.615	9.838	.873
B/L	.767	.149	-.150	23.577	1.255	-1.752	.829
B/M	.751	.014	.272	23.905	.122	3.288	.845
B/H	.778	.105	.908	21.560	.801	9.591	.849

Table VIII

Intrercepts for Excess and Returns on Six Portfolios formed on Size and BE/ME

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

Portfolio	A	t(a)
S/L	.089	1.685
S/M	.0149	2.916
S/H	.0143	2.597
B/L	.0025	.659
B/M	.0024	.373
B/H	-.0036	-.662

(b) $R_M - R_{Ft} = a + s\,SMB_t + h\,HML_t + e_t$

Portfolio	a	t(a)
S/L	.0058	.579
S/M	.0110	1.200
S/H	.0109	1.111
B/L	.0107	1.118
B/M	.0113	1.203
B/H	.0057	.557

(c) $R_M - R_{Ft} = a + b\,(R_{Pt} - R_{Ft}) + S\,SMB_t + e_t$

Portfolio	a	t(a)
S/L	-.0052	-1.175
S/M	.0029	.643
S/H	.0039	.738
B/L	-.0001	-.022
B/M	.0025	.615
B/H	-.0008	-.141

(d) $R_M - R_{Ft} = a + b\,(R_M - R_{Ft}) + h\,HML_t + e_t$

Portfolio	a	t(a)
S/L	.0088	1.717
S/M	.0150	2.937
S/H	.0145	2.986
B/L	.0024	.655
B/M	.0015	.419
B/H	-.0033	-.819

(e) $R_M - R_{Ft} = a + b\,(R_M - R_{Ft}) + s\,SMB_t + h\,HML_t + e_t$

Portfolio	a	t(a)
S/L	-.0047	-1.066
S/M	.0016	.366
S/H	.0004	.108
B/L	.0005	.137
B/M	.0013	.341
B/H	-.0046	-1.059

Table IX

April Seasonals in the Returns on Dependents and Explanatory Portfolios

$$R_M = a + b\,T_t + e_t$$

Where T is a dummy factor

= 1 in April months
= o in non-April months

Portfolio	a	B	T(a)	t(b)	R^2
S/L	.0174	-.024	1.749	-.063	-.01
S/M	.0222	-.015	2.377	-.456	-.01
S/H	.0231	-.023	2.192	-.608	-.01
B/L	.0106	-.018	1.142	-.558	-.01
B/M	.0101	-.025	1.076	-.738	-.01
B/H	.0048	-.014	.441	-.361	-.01
$R_{M-R}F$	,0088	.010	.781	.024	-.01
SMB	.0124	-.002	3.942	-.146	-.01
HM L	-.0002	.003	-.006	.184	-.01

Table X

January Seasonals in the Returns on Dependents and Explanatory Portfolios

$$R_M = a + b\,T_t + e_t$$

Where T is a dummy factor

= 1 in January months
= o in non-January months

Portfolio	a	b	t(a)	t(b)	R^{-2}
S/L	.0169	-.016	1.689	-.470	-.01
S/M	.0223	-.015	2.378	-.471	-.01
S/H	.0220	-.008	2.073	-.20	-.01
B/L	.0092	-.001	.987	-.02	-.01
B/M	.0090	-.009	.948	-.28	-.01
B/H	.0037	-.000	.336	.011	-.01
$R_{M-R}F$	.0065	.0305	.578	.757	.004
SMB	.0131	-.010	4.164	-.91	-.01
HM L	-.002	.005	-.048	.32	-.01

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