AN EMPIRICAL COMPARISON OF CAPM AND THREE FACTOR FAMA FRENCH MODEL WITHIN THE FRAMEWORK OF MOMENTUM AND CONTRARIAN EFFECT

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Abstract
The current study examined the time-varying risk-premium relationship of the Indian stock market through the adoption of the one factor Capital Asset Pricing model and the French-Fama three-factor model in the framework of cross-sectional momentum and contrarian effects. Over the five-year study period, i.e. from April 2012 to March 2017, the portfolios (momentum and contrarian) were framed using monthly returns of all the listed stocks on BSE 500 index having complete data. The research employed multiple regression technique to analyze the impact on stock returns of market risk, size risk and value risk. The results showed that the relationship between risk and premium varies over time, and the opportunities for arbitrage based on the winner and loser portfolios increase and decline over time. Overall findings of the study confirmed that the three-factor model given by Fama and French was found to be superior to the conventional one-factor CAPM model and suggested the use of the multifactor asset pricing model for investment decision consideration.

KEYWORDS: Momentum, Contrarian, Capital asset pricing model, Fama and French three factor model

1. INTRODUCTION

The manner risk of an investment influences investors' expected return is a key problem in finance. The aim of investors is to maximize the expected return from the portfolio, pertaining to an acceptable risk level (or minimize risk, pertaining to an acceptable expected return). EMH has become one of the most prevalent trends of financial market research that has attained tremendous attention from financial economists in the field of capital market efficiency. In an efficient market, all available information is completely and promptly reflected in the asset prices, according to Fama (1970). Market Efficiency affects an investor's investment strategy since there will be no undervalued or overvalued stocks in an efficient market. The efficient market theory claims that the fluctuations in stock prices are unpredictable and follow no regular pattern. By taking more risks, investors can just earn more returns. Momentum and contrarian effects, categorized as two robust market anomalies, serve as an opportunity for fund managers to construct beta-neutral and superior return portfolios. Momentum and contrarian strategies are two contrasting investment strategies that aim to produce excess returns by analyzing historical price or return data to predict future stock performance trends. Momentum Strategy assumes that stocks that have done well in the past will do so, in the future as well. The momentum strategy is to buy stocks that have strong past successes and to sell stocks that have done poorly. On the other hand, the contrarian strategy assumes that stocks whose past performance is poor would do well in the future, so it recommends buying losers and selling winners on the basis of past results. Based on the Markowitz paradigm, The Capital Asset Pricing Model (CAPM) presented a coherent structure for understanding the risk and return problem for the first time. CAPM is a single index model suggested by Sharpe (1964) and Lintner (1965) respectively. Fama and French (1993) suggested a multifactor model focused on market risk as well as the size- and value-based for better return estimates. The current research assesses whether a Fama and French three-factor model performs better than conventional CAPM model in the Indian stock market.

The remaining part of the paper is constructed according to as follows: Section 2 presents a review of the literature, Section 3 outlines data and methodology, and the empirical findings of the study are shown in section 4. The paper is concluded in Section 5.

2. LITERATURE REVIEW

Several empirical studies have documented that investment strategies both momentum and contrarian give an abnormal return to investors. De Bondt and Thaler (1985) sort firms based on three years of historical returns and found that the previous loser portfolio's average annual return is higher than the previous winner portfolio's average return. On the other hand, Jegadeesh and Titman (1993) sort NYSE-listed stocks on the basis of their previous six-month return and reveals that investing in a group of previous winner stocks results in a higher average return than investing in a group of previous losers. Jegadeesh and Titman (2001) reaffirmed that the momentum strategy does not deliver an abnormal return after 12 months. The coexistence of momentum and contrarian strategies in the US market has been reported by a wide body of literature (Conrad and Kaul, 1998; Grundy and Martin, 2001; Karolyi and Kho, 2004). The profitability of both momentum and contarian strategies is not limited to the U.S. stock market, but has also been observed in other international markets as well. Alonso and Rubio (1990) for the Spanish stock market, Swallow and Fox (1998) for the New Zealand stock market reported the presence of contrarian effect. The asset pricing model is crucially important for individual as well as institutional investors because it helps in the capital market pricing aspects of individual assets. De Bondt and Thaler (1985), Lee and Swaminathan (2000) and Rouwenhorst (1998) strongly support the risk-based momentum explanation arguing that winner and loser portfolio returns tend to converge with the anticipated market risk premium. Sehgal and Balakrishnan (2008) tried to understand the source of momentum gains in the Indian context which was found to be logical through the Fama-French three-factor model. Shegal and Jain (2011) tested the presence of momentum effect in stock and sector returns and the predictive capacity of the risk-factor model. Fama-French three-factor model also remains controversial as a rational and reasonable risk model (Black, 1993; Griffin, 2002; Cooper et al., 2004).

3. DATA AND METHODOLOGY

3.1 Data sources

The study relies on secondary data obtained from the CMIE Prowess database. For the five-year study period , i.e. from April 2012 to March 2017, the monthly closing adjusted stock price data of all the listed stocks on the BSE 500 index having complete data has been gathered from CMIE Prowess database. The stocks that did not meet the eligibility criteria were excluded from the sample, and out of 500 a final sample of 330 stocks has been formed. For the return on market portfolio the BSE index (sensex) is used as the proxy. The 91-day Treasury Bill rate is collected from the Reserve Bank of India (RBI) website, which is a proxy for risk-free rate in India.

3.2 Portfolio construction

The current paper explored the power of asset pricing models including one-factor CAPM and three-factor Fama & French model, which captured the attention in the international potential investors to explain asset pricing in the Indian stock market in the context of momentum (winner portfolio) and contrarian (loser portfolio) effects. The research adopted Jegadeesh and Titman's (1993) methodology for portfolio construction. FxH is the approach in which stocks were chosen and kept for H months i.e. (holding period) on the basis of returns over the past F months (i.e. formation period). At the beginning of each month, selected stocks were ranked in descending order and then evenly divided into 10 equal weighted portfolios based on their past returns during the formation period. Top performing stocks are set aside as the portfolio of winners (1st portfolio) and the worst-performing stocks are set aside as the portfolio of losers (10th portfolio). The momentum strategy involves buying the winner portfolio at the same time selling the loser portfolio and holding that position for H months (holding period) while contrarian strategy involves purchasing the loser portfolio and selling the winner portfolio at the same time, and holding that position for H months (holding period). The strategies analyzed in this study include formation period of 6 and 12 months, and holding periods of 3, 6,12 and 36 months. The study evaluates a total of 16 strategies out of which 8 are strategies of momentum and 8 are strategies of contrarian effect. For the sample period, the study employs monthly market portfolio return, monthly size, and monthly value to measure market , size, and value factor. Market capitalization is used as proxy for firm size. The value of the stock is calculated using Book-to-Market (B/M) ratio.

3.3 Econometric models:

Following are the models studied; to evaluate which model is the better predictor in the Indian stock market.

3.3.1 CAPM (Capital Asset Pricing Model):

CAPM model suggests the anticipated excess return on stocks depends on its sensitivity to the expected return on the market. The study used the market-index model equation mentioned below to test any extra-normal returns arising from momentum or contrarian strategies:

$$RPt - RFt = \alpha + \beta(RMt - RFt) + ei$$

Where,

$RPt - RFt = Excess\ Return\ on\ a\ portfolio,$
$RMt - RFt = Excess\ return\ on\ the\ market\ factor,$
$\alpha = Measure\ of\ abnormal\ profits,$
$\beta = Sensitivity\ measures\ of\ stock\ returns\ to\ the\ market\ returns,$
$ei = Error\ term.$

3.3.2 Fama-French Three Factor Model (FFM):

Fama and French (1993) suggested a three-factor model to explain stock return fluctuations, introducing two new risk factors to the CAPM model: size (SMB) and book-to-market (HML) ratio. The expected excess return on a portfolio or stock can be written according to a three-factor model as,

$Rpt-Rft=\alpha+ \beta m(RMt-Rft)+\beta sSMBt+ \beta hHMLt+ \varepsilon t$
$RPt - RFt = Excess\ Return\ on\ a\ portfolio,$
$RMt - RFt = Excess\ return\ on\ the\ market\ factor,$
$\alpha = Measure\ of\ abnormal\ profits$
SMBt= average return on stock of the small-minus-big companies
HMLt= average return of the high-minus-low book to market ratio
βm, βs, βh = slope coefficients of multiple regressions
$et = Error\ term$

4 RESULT ANALYSIS & DISCUSSION

4.1 Results of Descriptive statistics of the momentum and contrarian strategies

Table 4.1: Descriptive statistics of the momentum and contrarian strategies

	MOMENTUM EFFECT								CONTRARIAN EFFECT							
Statistics	F6H3	F6H6	F6H24	F6H36	F12H3	F12H6	F12H12	F12H36	F6H3	F6H6	F6H24	F6H36	F12H3	F12H6	F12H12	F12H36
Mean	0.051	0.053	0.054	0.057	0.059	0.058	0.060	0.063	0.039	0.041	0.041	0.046	0.047	0.047	0.048	0.054
Standarddeviation	0.478	0.333	0.190	0.064	0.310	0.289	0.164	0.143	0.566	0.344	0.222	0.107	0.485	0.327	0.209	0.189
skewness	-0.096	0.104	-0.464	0.098	-0.308	0.041	0.091	0.887	-0.314	-0.774	-0.920	-0.338	-0.476	-0.724	-0.745	-0.090
kurtosis	2.637	2.942	2.288	1.954	2.405	2.858	2.759	2.809	2.615	3.643	3.108	1.727	2.574	3.972	3.071	1.991
Jarque-Bera	0.401	0.106	2.734	1.132	1.744	0.061	0.183	3.185	1.290	6.318	6.792	2.077	2.580	6.844	4.447	1.050
Probability	0.000	0.000	0.003	0.000	0.042	0.000	0.001	0.020	0.000	0.001	0.034	0.000	0.000	0.033	0.011	0.002

Source: Author's own work

Table 4.1 presents the results of descriptive statistics for the 3, 6, 12, and 36 month holding period returns over 6 and 12 month formation periods for different portfolios. The holding period of 3, 6, and 12 months can be viewed as a short-term momentum and contrarian strategy, and further 36 months holding-period study would certainly explain the long-term success of momentum and contrarian investment strategies. As reported in Table 4.1 above, the momentum strategies obtained higher mean returns for all holding periods than the contrarian strategies. For both momentum and contrarian strategies, the longer holding period, the higher is the mean return. Standard deviations of momentum returns are less than those of the contrarian, suggesting that the winners are less volatile than the losers. The momentum effect is found to be negatively skewed for all investment strategies except for the formation of 12 months and the holding period of 6,12 and 36 months. In addition, the contrarian effect of all investment strategies is found to be negatively skewed. Furthermore, for all holding and formation periods considered in the analysis, Jarque-Bera statistics revealed the non-normal distribution of momentum and contrarian portfolios.

4.2 Stationarity Analysis of data:

Augmented Dickey Fuller (ADF) test has been used to check the stationarity of momentum and contrarian investment strategies. Results in Table No 4.2 revealed that there is no unit root in the data from a time series. In both momentum and contrarian y effect, for the monthly return series, p-value is too lower than alpha (0.05). ADF t-statistics is too low compared to MacKinnon's tabularized value, i.e. t-critical values at 5 percent significance level proved stationarity of return series. Hence it confirms that for all portfolios under consideration, null hypothesis (data has unit root) is rejected and thus data is stationary.

Table 4.2: Stationarity Analysis using ADF (Augmented Dickey–Fuller test)

MOMENTUM EFFECT				CONTRARIAN EFFECT			
Strategies	probability	T-statistic	T-Test critical values 5% level	Strategies	probability	T-statistic	T-Test critical values 5% level
F6H3	0.004	-4.436	-3.492	F6H3	0.005	-4.410	-3.492
F6H6	0.002	-4.642	-3.497	F6H6	0.012	-4.074	-3.497
F6H24	0.057	-3.863	-2.925	F6H24	0.000	-8.406	-3.511
F6H36	0.051	-3.610	-3.622	F6H36	0.000	-6.939	-3.633
F12H3	0.003	-4.568	-3.494	F12H3	0.001	-4.832	-3.495
F12H6	0.016	-3.261	-3.497	F12H6	0.010	-4.158	-3.497
F12H12	0.038	-3.047	-2.925	F12H12	0.036	-3.648	-3.509
F12H36	0.021	-4.366	-3.622	F12H36	0.014	-4.360	-3.645

*Mackinnon(1996) one- sided p-values

H_{01}: *Data has unit root*

Source: Author's own source

4.3 Regression results of CAPM and Fama & French three factor model

Table 4.3: Regression estimates of CAPM and Fama & French three factor model

	Momentum		Contrarian		Momentum		Contrarian	
Parameters	CAPM	FFM	CAPM	FFM	CAPM	FFM	CAPM	FFM
6 months formation period								
	3 month holding period				6month holding period			
Alpha(α)	0.0034*	0.0044**	0.0025***	0.0025***	0.0074**	0.0059**	0.0026***	0.0025***
β_{MKT}	0.0096**	-0.0007	0.0373***	0.0360**	0.0007	-0.0077**	0.0067**	0.0003
β_{SMB}		0.0283*		0.1932*		0.0268*		0.4516***
β_{HML}		0.2662**		0.1710**		0.3364***		0.3084***
	12 month holding period				36 month holding period			
Alpha(α)	0.0149***	0.0152***	0.0027***	0.0027***	0.0029***	0.0218***	0.0026***	0.0029***
β_{MKT}	-0.0100***	-0.0120*	-0.0023*	-0.0038**	0.002	-0.0021**	0.0042**	0.0041**
β_{SMB}		0.0343**		0.3542***		0.1642***		0.1109**
β_{HML}		0.2818***		0.1901**		0.2538***		0.1545**
12 months formation period								
	3 month holding period				6month holding period			
Alpha(α)	0.0078**	0.0130***	0.0030***	0.0027***	0.0090***	0.0148**	0.0030***	0.0028***
β_{MKT}	0.0093**	0.0003*	0.0249**	0.0132**	0.0016*	0.0008	0.0069**	-0.0058**
β_{SMB}		0.0251		0.2829***		0.0792**		0.3850***
β_{HML}		0.4219***		-0.0279		0.3535***		0.0891**

	12 month holding period				36 month holding period			
Alpha(α)	0.0112***	0.0189***	0.0031***	0.0029***	0.0020***	0.0224***	0.0017***	0.0030***
β_{MKT}	-0.0100*	-0.0048**	-0.001	-0.0031	0.0020*	0.0021**	0.0084**	0.0114***
β_{SMB}		0.1425**		0.3452***		0.2692***		0.1909**
β_{HML}		0.2838***		-0.0434**		0.1782**		-0.0860**

The asterisks correspond to the level of significance, where *p<0.10; ** P<0.05; ***P<0.01.
Source: Author's own source

Table 4.3 provides risk-adjusted returns for momentum and contrarian investment strategies with a formation period of 6 and 12 months and holding periods of 3, 6, 12, and 36 months, using the CAPM model and the three-factor model of Fama and French. Preconditions of stationarity, multicollinearity, autocorrelation, and heteroscadasticity have been tested before performing regression. Alpha (the intercept value) is expected to be close to 0. However, a significantly positive (negative) alpha implies superior (inferior) results. Results from both the CAPM and Fama French three-factor models indicate that alpha values are higher than zero for all strategies that imply excess returns are unexplained by the models. Alpha values are higher for the momentum portfolios than for the contrarian portfolios. On the whole, these findings indicate a presence of strong momentum effect in the Indian stock market. Market risk loading (β MKT) for contrarian portfolios is higher than momentum portfolios in both CAPM and Fama &French three factor models, suggesting that contrarian portfolios are more sensitive to market risk. Significantly positive size factor loadings (βSMB) suggest that small companies are over-represented in both momentum and contrarian portfolios. This means small firms can produce high abnormal returns and small firms are usually more volatile than big firms. Portfolios with significant positive value coefficients (β HML) indicate that they primarily consist of value stocks. The value factor (β HML) exhibits significant and positive coefficients, with the exception of contrarian investment strategies with a formation period of 12 months and a holding period of 3,12 and 36 months suggesting that they are heavily comprised of value stocks.

5. CONCLUSION:

Standard risk models such as the Capital Asset Pricing (CAPM) one-factor model and the Fama French three-factor model are used to forecast the relationship between portfolio returns and risk factor returns. The research performed an empirical comparison of CAPM and the Fama French three-factor models in the Indian stock market. Following Jegadeesh and Titman (1993), the study period develops equal-weighted momentum and contrarian portfolios. The major outcome is that all eight strategies analyzed yield statistically significant returns, and the momentum effectively outperforms contrarian strategies in all of them. In case of momentum effect F12H12 is the perfect combination of formation and holding period resulting in the best performing strategy. Similar to previous research, superior profits are generated by strategies with relatively long formation periods and short holding periods. It is observed that both the momentum and the contrarian portfolios consist of small capitalized and value stocks, while the contrarian portfolios are more subject to market risk. In Indian stock market, Fama and French's incorporation of size and value risk factors in their three-factor model in addition to market factor indicates superiority over the CAPM model. Despite the different formation and holding periods, alpha values (α) vary statistically from zero and are statistically significant, indicating that both CAPM and Fama French three-factor risk models are unable to completely explain the momentum/contrarian returns.

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