SIZE AND VALUE RELATED ANOMALIES IN INDIAN STOCK MARKET: EMPIRICAL STUDY USING FAMA FRENCH THREE FACTOR MODEL

R. Gautam and U. Holani

Department of Commerce, Jiwaji University

ABSTRACT

Until very recent times, generous research had been conducted to test the relevance of the Capital Asset Pricing Model (CAPM) in predicting the price fluctuations and explaining the excess return of the portfolios. But with increased research came many pragmatic evidence which challenged the reliability of CAPM. Thus, to overcome these irregularities many advanced models were developed taking more beta factors into the equation. Fama French in 1992 developed a model which claimed that it could better explain the price fluctuations of stocks in comparison to CAPM and major anomalies of CAPM were captured by this three-factor model of Fama French. This multifactor model includes three factors comprising of market premium, firm size, firm value of individual firms the market. This paper is an attempt to empirically test the Fama French model for size and value anomalies in the Indian stock market. The dataset includes the most traded 50 companies on NSE for the time period of April 1, 2010 to March 31, 2020. The portfolios are constructed every year on size(market capitalizations of the firms) and value (book to market ratio) basis to check for the inconsistencies. The results indicate that the three-factor model improves explanator power for portfolio returns. A significant effect of market risk premium, size premium and value premium was also detected on the returns of the assets.
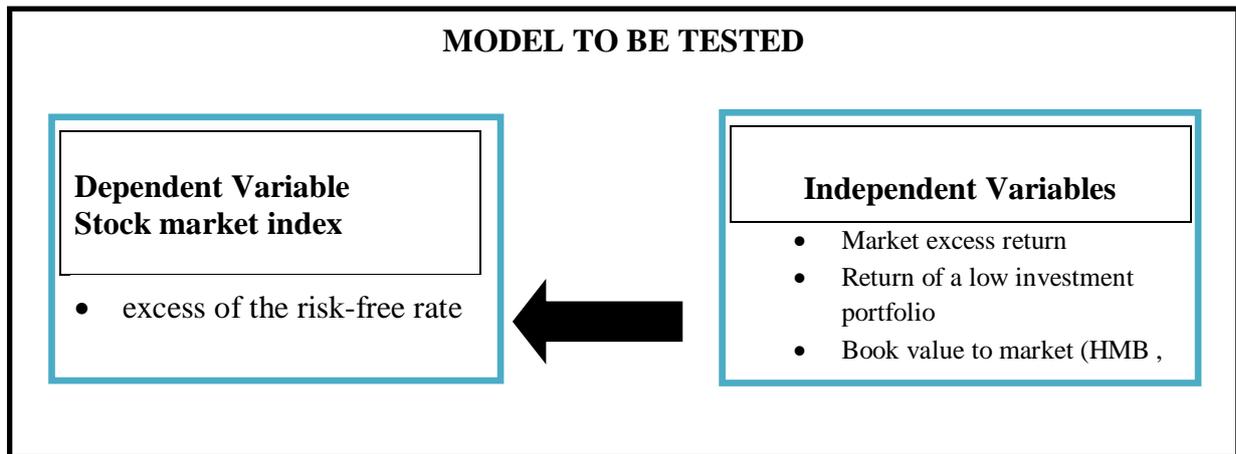
Keywords: CAPM, Fama-French, Stock Market.

Introduction

The first model to explain the general equilibrium for asset pricing was developed by three Nobel laureates (William F. Sharpe, 1964; Linter, 1965; Mossin, 1966). In their model, they predicated a powerful cross sectional association between market beta and expected return and further categorized that it is only market beta that explains the variations in expected return in the financial assets. But with changing environment and inquisitive researchers, today abundance literature is available explaining variations other than market beta to determine anticipated return. Some anomalies like value effect, investment effect, leverage effect, liquidity effect, Size effect, and price earning effect have been instituted from these research. These disturbances have shook the earlier prediction of linear CAPM model. Cessation of this single factor theory lead to development of new hypothesis and emergence of multifactor models like Fama-French (Three Factor model),Carhart four-factor model to study irrational exuberance and investor behavior. In their path breaking empiricism, Fama-French (1992) confirmed failures of CAPM to observe the inability of market beta to report the cross-sectional disturbances in security returns. This three factor model analyzed the size and value effect on the expected returns. Thus, factor model with its SMB (proxy for firm size) and HML (proxy for book-to-market equity) risk factors is undoubtedly an important finding in contribution to asset pricing. Also it is worth noting that FF model is an extension to CAPM model by adding size risk factors and value risk factor to the market risk factor.

It is the asset pricing model which considers the fact that value and small – cap stocks outperform market on regular basis. Much empirical evidence is now available depicting the presence of size and value effect in the developed markets. But when considering the developing Asian markets like India, there is absence of such research or the results are inconclusive. This paper is an attempt to fill this research gap in the Indian context and examine whether the size and value anomalies are persistent in the Indian asset market or not.

MODEL TO BE TESTED

Dependent Variable Stock market index

- excess of the risk-free rate

Independent Variables

- Market excess return
- Return of a low investment portfolio
- Book value to market (HMB ,

Conceptual Framework

Market excess return:
It indicates a premium over minimum return an investor expects for perceived higher level of risk. Minimum return is benchmark return of risk free assets like government-issued bond or certificate of deposit.

Return of a low investment portfolio:
There exits direct correlation between the risk and return movements of a portfolio. To bring about high return, an investor must be simultaneously willing to increase his risk profile.

Book value to market (HMB, SMB):
SMB (Small minus big): it measures the historic surplus of small capitalization companies over the big capitalization companies. The main theoretical rationale of SMB is that in the long period of time, small-cap companies bear higher returns to the big-cap companies. The concept is size effect based on a market capitalization of a company.
HML (High minus Low): concept based on value premium (book-to-market ratio) of the companies. It illustrates the stretch between the companies with high and low value premium (book-to-market ratio). The main theoretical rationale of HML in the long run is that value enterprises ((high book-to-market ratio) enjoy larger returns tan the growth companies (low book-to-market ratio). Calculation of beta coefficient for both HML and SMB is done through a linear regression equation.

Review of Literature

Throughout the history, generous research has been done to test the relevance of the Capital Asset Pricing Model (Sharpe 1964). This model states that for capital market to be effective and in harmony, there must be positive and straight connection between expected profit (risk premium) and the market beta which can also be quantified as covariance between return on individual security and market return. Post 1980, studies had stated to contradict the base of CAPM model that market beta is sole representative of variations in excess return. it started the unearthing of multifactor models which proposed that there are "n" number of factors which could define the variations in market securities returns. Apart from market beta there are a few firm-explicit components which impact the informative intensity of market returns, for instance, firm size, book-to-advertise value proportion (B/M); and profit to-value proportion (E/P). Deciphering the anomalies lead to development of Fama and French (1992, 1993, 1995, 1996) multifactor model. Fama and French (1993) in total instituted five elements in this model namely size, beta, value, HML (high minus low) and SMB (small minus big) as most customary elements jointly explaining major disturbances in cross section of returns as proposed by Fischer et. al. (1972) using time series analysis. Fama (1998) additionally examined 13 international markets in which values stocks outperformed growth stocks in 12 international markets during the period of 1975-1995 and in almost 11 out of 16 markets size effect was significant. These

analysis lead to further establishment of the fact that CAPM model is invalidated. Mohanty (2002) analyzed if any of the above firm-explicit features clarify the cross-sectional variety in stock returns utilizing the famous Fama and Macbeth's strategy. It was discovered that estimate (estimated by market capitalization), showcase use, cost to-book esteem, and profit to-value proportion were exceedingly connected with stock returns. While size and cost to-book-esteem were adversely related with stock returns, income to-value proportion and market use were observed to be emphatically corresponded with stock returns. The investigation likewise found a level connection among returns and beta. Gaunt (2004) tested for the three factor regression equation on Nepalese capital market and results demonstrated that big value-stocks sowed excess returns over small growth-stocks proving that the size related anomalies exist in the financial market. And proof that the BM factor assumes a job in resource evaluating. Tripathi (2008) empirically analyzed the negative relationship between market capitalization and price earnings ratio trough a forward integration approach and on contrary a positive relationship for debt equity and BE/ME. The sample of is study was 455 companies which were part of S&P CNX 500. Connor and Sehgal (2001) probed the presence of abnormalities in Indian equity market supported by Fama model and strong extensive presence of size, value and market beta factors was readily noticeable for Crisil 500 stocks from 1989 to 1999. . In another wide ranging study based in Korea, Hong Kong and Malaysia Chui and Wei (2000) empirically found that found that B/M can demonstrate the cross-sectional variety of expected returns. This research was considered noteworthy in all of the business sectors with the exception of Taiwan. It ought to be referenced that all the above investigations don't utilize the explicit FF three-figure demonstrate their examination thusly no zero-speculation portfolios are shaped based on size and B/M factors. Though, they utilize firm size and B/M proportion as unmistakable factors specifically in their relapse models. There are not very many investigations to check the power of the FF three-calculate demonstrate the Asian markets.

Liew and Vassalou (2000) analyzed the overabundance comes back from the SMB, HML, and WML factors by taking information from ten created markets. They found high premiums for the three factors in four, nine, and eight markets, separately. Veeraraghavan (2003) looked at the logical power of the FF three-factor display for Hong Kong, Korea, Malaysia, and Philippines. They found both size and B/M impacts in every one of the business sectors and suggest that the three-factor demonstrate recommends a restricted portrayal of the normal returns for these Asian markets over the 1990s. Cakici, Fabozzi et al. (2013) Subsequent to shaping portfolios arranged on size and book-to-advertise proportion, and estimate and slacked energy, we utilize three factor models to clarify the profits for these portfolios dependent on components built utilizing nearby, U.S., and total worldwide created securities exchanges information. Chen, Zhang et al. (2011) analyzed new three-factor display diminishes the greatness of the strange returns of an extensive variety of peculiarities based exchanging techniques, regularly to irrelevance. The model's execution, joined with its monetary instinct, recommends that it very well may be utilized to get expected return evaluates. The other disturbances like sales growth, long-term past return, cash flow yield and E/P disappear in three factor model. Jegadeesh and Titman's (1993) in there research gave the similar concept of Momentum strategy which is all about selling stock with low returns and buying stocks with high returns. In present scenario this strategy is most talked about model which indicates past winners perform well and past losers perform poorly. Chowdhury (2017) in his paper included three factors book to market risk, size risk and market risk premium. He constructed nine portfolios with closing prices of thirty stocks of Chittagong Stock Exchange from 2010 to 2014 and study concluded that, stocks with small market capital outperform that of large market capital and also observed that higher book to market ratio yields poor earnings but inefficient market and rumor driven market, the Fama French model had weaker explanatory capacity but positive impact on stock return at CSE.

Through survey of various literature overview it was distinguished by the researcher that mostly researches find the weak impact over the stock market or monthly excess rate of returns of stock by using asset pricing models and FF3F. They estimate that capital Market should be effective and harmony and there is straight and forward connection in excepted profit for Hazardous resources.

This study will be aimed to analyze the impact of market anomalies over Indian Stock Market Company listed on NSE. This study will be using Fama French three factor model to see the affect on excess of the risk-free, due to the changes in the return of high/low investment portfolio, return of a high/low return-on-equity portfolio and market excess return.

Hypothesis and Objective:

H_{11}:The Fama-French three-factor model explains the variation in Indian stock returns.

Data & Research Methodology

Data

Indian equity market has been growing at a moderate pace in the past decade. In the financial year 2020, over 5000 companies were listed on BSE and 1,600 on BSE. The sample data taken into the analysis consists of 50 companies listed on nifty. The time period taken into study is 2010 to 2020 monthly period. the formation of the portfolios was done in the month of September order to take into consideration the earning announcements, dividend announcements, publication of financial statements and reports, any expansion plans or change in managements etc. which could substantially effect the investment priorities of the investors. The rationale behind taking Oct-Sept as portfolio construction dates is that since all the companies as per Companies Act, 2013 have to disseminate their annual reports to their shareholders, so in order to fully reflect the investor behavior with regard to company's fundamentals and financials, the market price will be more reflective of their current behavior. The data in regard to closing prices of shares and monthly market returns the analysis is taken from the CMIE Prowess. The data for risk free rate based o 91 days t bills is taken from RBI database. For the convenience in the analysis the adjusted share price series have been converted into return series using arithmetic returns in excel on monthly basis.

The accounting information of the selected sample organizations for financial years 2010 to 2020, all having the financial year starting from 1st April and ending on 31st marc. The number of shares outstanding and book value per share are recorded in March end (financial year end) in each year for sample companies. The above sample will be helpful in conducting a complementary analysis to analyze the applicability of model

Independent variables:

Rp= Individual company returns of the selected companies

$$Rp = \frac{PP1 - PP0}{PP0}$$

*PP*0- Adjusted closing price of the individual company's previous month

*PP*1- Adjusted closing price of the individual company's current month

Rm= Market return calculated similar to individual returns

Rf= Risk free return(91 day T-bill yield)

Size(determined by Market capitalization) = Share price as on October 't' *

No. of shares Outstanding in March 't'

Value(determined by P/B ratio)= Market price of a share /Book value per share in March't'

Formation of Portfolio

Test for stationary of the prices series was undertaken using Augmented Dickey Fuller Test and found only 2 companies with non stationary series which were subsequently removed.

Size Value Sorted Portfolio: For each year , all the selected sample companies were sorted on the basis of there market capitalization in the month of September. The calculation of market capitalization was done by no of share outstanding into market price per share (both values crosspond to the month of September). The sample is ten divided into 2 parts by concept of median, the large market cap companies denoted by B ad small cap companies denoted by S.

Price to Book Ratio: is calculated as there is 3 months time difference in financial year and portfolio construction year. It is calculated by dividing book value of equity at the end of financial year by market value at the need of same year. The SB portfolio are first ranked and ten each divided in 30/40/30 ratio each representing low, medium, high respectively . This intersection between size and value gave 6 portfolio namely S/L, S/M, S/M, B/L, B/M, B/H. each denoting their respective identical analogy as S/L represents small cap company with low book to price ratio. Average return of each portfolio are ten calculated.

Factor Portfolio: To examine the significance of the FAMA FRENC model, 2 factor model are constructed namely SML and HML. To evaluate the size effect SMB (small minus big) is used as proxy. The difference is now for every month between simple average of returns of 3 small cap portfolio namely - S/L, S/M, S/H and the simple average of returns on three big stocks namely -B/L, B/M, B/H. To evaluate the value effect as measured by price to book ratio HML is calculated as difference between as simple average of returns on two high P/B portfolios (S/H and B/H) with the simple average of returns on two low P/B ratios (S/L and B/L). Both these factor models are independent of each other in calculation terms.

Methodology of Model

In order to validate the Fama Model, we use same Fama-Macbeth approach of two pass regression. E-views is used to test the equations:

To check for the stationary in the returns of the stocks and the market ADF test is applied. Initially, a times series regression is run to assess the beta of market portfolio with the three model Fama-French model:

$$E[R_{pt}–R_f]= \alpha +\beta_1 E[R_{mt}-R_f] +\beta_2,SMB_t + \beta_3 HML_t + \varepsilon_t$$

Where, Dependent Variable = $E[R_{pt}–R_f]$

Independent Variable = $E(R_m -R_f)$, SMB , HML

Then, the next step is to run the two-pass (TP) cross-sectional regression method on the equation:

$$E[R_{pt}–R_f]= \lambda_0 +\lambda M\beta_1 + \beta_2\lambda SMB + \beta_3\lambda HML+ \varepsilon_t$$

Where, Dependent Variable = $E[R_{p(t)} – R_f]$,
Independent Variable = $\beta_1, \beta_2, \beta_3$ (Calculated from initial step)

Furthermore , In order to check whether $\beta_1, \beta_2, \beta_3$ variables are linearly related to excess premium and there is a existence of non-systematic risk), the next step is first pass regression on the model

$$E[R_{pt}–R_f]= \alpha_P +\beta_1 P E[R_{mt}-R_f] +\beta_2,PSMB_t + \beta_3 HML_t + \varepsilon_t$$

Where, Dependent Variable = $E[R_{(t)p} – R_f]$
Independent Variables = $E(R_m -R_f)$, SP

Empirical Analysis & Discussion

The average number of companies partited on the basis of size and value portfolio.

		VALUE SORTED		
		LOW	MEDIUM	HIGH
SIZE SORTED	SMALL	7	10	7
	BIG	8	`10	8

Table 1: Mean of securities present in each size - value sorted portfolio

The descriptive statistics for the different portfolio formed shows existence of positive skewness and kurtosis in some of the sample companies whereas some show positive autocorrelation in their returns implying the effects of stale prices.

Further, The correlation matrix present a negative correlation between SMB and HML and positive correlation between SMB and Market Beta.

	Low	Medium	High	Low	medium	high
	α			p- val α		
Small	0.0045	.0006	0.0062	0.0026	0.3267	0.0021
Big	0.0041	0.0032	0.0765	0.0234	0.0071	0.3145
	Mkt. β			p- val Mkt. β		
Small	1.9872	0.0079	1.0902	0.0000	0.0000	0.0000
Big	0.0897	0.0076	1.7865	0.0000	0.0000	0.0000
	HML β			p- val HML β		
Small	0.7865	0.5290	0.8765	0.0004	0.0002	0.0000
Big	0.8754	-0.0082	-0.0987	0.4432	0.0000	0.0034
	SMB β			p- val SMB β		
Small	-0.8045	-0.7655	-0.0045	0.0003	0.0000	0.0008
Big	0.0344	-0.3502	-0.9786	0.0000	0.0945	0.0000
	Adj R2					
Small	0.9981	0.0324	0.8924			
Big	0.7543	0.3983	0.8179			

Table 2: Regressions of size and book-to-market sorted portfolio excess returns (Rt) on size (SMB) and value (HML).

The above table display the results of multiple regression of value and size effect in the portfolios. Outcome exhibit that abnormal returns are still present in the equation illustratingthat there could be added factors deciphering the unexplained variation. The market beta reveals the significant variation in the size effect but the same is not visible in the value effect. The results clearly demonstrate that small cap firms earn higher excess return than the large cap firms. Simultaneously the results also show that P/B stocks (Growth Stocks) does not yield higher returns in comparison to Low P/B stocks (Value stocks).

Conclusion

This research is an empirical attempt to test the relevance of Fama-French three factor model in the Indian market(NSE). Two significant anomalies that is size effect and value effect are tested on selected samples of 50 listed companies of NSE selected on market capitalization basis from 2014-2018.The findings reveal That the size related disturbances prevailin NSE market characterizing it as semi-efficient. The value effect which is lacking in the results elucidate the presence of abnormal returns signaling that there could be more factors to explain the variations. The presence of this anomalous behavior or deviation hints towards the irrational behavior of the investors and inefficient markets in India. But the significant reason or financial model is yet to be investigated or developed to clearly understand the existence of such anomalies or variations. Still even with extensive research both fundamental analyst and behavioral economist give different explanation to the presence of such anomalous behavior without coming to a common conclusion. But the future of asset prices rest on the discovery of a new theory and a new parsimonious models that could solve the existing challenges. The future perspectives on such research can be on exploring whether firm specific factors explain risk in broad asset classes like industry sorted portfolios, examining the role of business cycles on the asset pricing and company fundamentals, testing whether size effect is found only in emerging markets or developed markets or both. With this challenges in regard to the behavioral aspects or investors preferences should accounted for in prospective analysis. India being a growing financial market should deepen its equity investment horizon with more participation and probing for a robust ecosystem for investment management.

References

1. Black, F. (1972). Capital Market Equilibrium with Restricted Borrowing. The Journal of Business, 45, 444-455.

2. Chowdhury, E. (2017) Functioning of Fama-French Three-Factor Model in Emerging Stock Markets: An Empirical Study on Chittagong Stock Exchange, Bangladesh. Journal of Financial Risk Management, 6, 352-363.

3. Chui, A. C. W., & Wei, K. C. (2000). John and Titman, Sheridan, Momentum, Legal Systems and Ownership Structure: An Analysis of Asian Stock Markets.

4. Clive Gaunt (2004) Size and book to market effects and the Fama French three factor asset pricing model: evidence from the Australian stock market, AFAANZ, 2004. Published by Blackwell Publishing. Received 17 January 2003; accepted 7 February 2003 by Robert Faff (Editor).

5. Connor, G. & Sehgal, S. (2001). Tests of the Fama and French Model in India, London School of Economics and Political Science,Discussion Paper, 379(May), 1–23.

6. Drew, M. E., & Veeraraghavan, M. (2003). Beta, Firm Size, Book-to-Market Equity and Stock Returns: Further Evidence from Emerging Markets. Journal of the Asia Pacific Economy, 8, 354-479.

7. Fama, E. F., & French, K. R. (1993). Common Risk Factors in the Returns on Stocks and Bonds. Journal of Financial Economics, 33, 3-56.

8. Fama, E. F., & French, K. R. (1996). Multifactor Explanations of Asset Pricing Anomalies. The Journal of Finance, 51, 55-84.

9. Fama, E. F., & MacBeth, J. (1973). Risk, Return, and Equilibrium: Empirical Tests. Journal of Political Economy, 81, 607-636.

10. Jegadeesh, N., & Titman, S. (1993). Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency. The Journal of Finance, 48, 65-91.

11. Liew, J., & Vassalou, M. (2000). Can Book-to-Market, Size and Momentum Be Risk Factors That Predict Economic Growth? The Journal of Finance, 57, 221-245.

12. Lintner, J. (1965). Security Prices, Risk and Maximal Gains from Diversification. The Journal of Finance, 20, 587-615.

13. Long Chen, Robert Novy-Marx and Lu Zhang (2011) "An Alternative Three-Factor Model" SSRN Electronic Journal, April 2011.

14. Mossin, Jan. (1966). Equilibrium in a Capital Asset Market, *Econometrica*, 34(4), 768-783.

15. Nusret Cakici, Frank J. Fabozzi and Sinan Tan (2013) "Size, value, and momentum in emerging market stock returns" Emerging Markets Review 16 (2013) 46–65.

16. Pitabas Mohanty (2002) Evidence of Size Effect on Stock Returns in India Vol. 27, No. 3, July-September 2002.

17. Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. The Journal of Finance, 19, 425-445.

18. Tripathi, V. (2008). Company Fundamentals and Equity Returns in India, *SSRN*