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Study of size and value premium in south Asian countries

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Abstract: This study investigates the applicability of Fama and French's three factor model for four Asian stocks market by analyzing monthly stock returns data, dated January 2003 to December 2011. The findings provide evidence for market factor to be significant in explaining the variations of stock returns in sampled stock markets. Further results suggest the significance of size and value factors in all markets except DSE.

Key words: *Size and value premium; Three factor model; CAPM*

1. Introduction

Capital asset pricing model (CAPM) explained the relationship between stock return and market return by a single factor model. To overcome the limitations of CAPM, Fama and French (1992) investigated returns of stocks and they come up with two additional risk factors that were not previously been included in CAPM, these additional risk factors are size premium and value premium. They concluded that there is no relationship between stock returns and market beta factor. Fama& French (1993) extended their previous study and developed a model which is known as Fama& French three factor (FF) model. The purpose of this study is to investigate the applicability of FF model on four stock markets. Specifically, this study focused on size and value premium factors in these markets.

This paper is organized as follow: Section II describes the literature review, section III describes research methods. In next section IV size and value factors are tested, Final section V discusses the results and conclusion.

2. Literature review

There are many studies which test the ability of three factor model to explain the stock return variations. Some researchers compare the three factor model and CAPM models in their studies. Hassan and Javed (2011) examined the relationship between size and value premium and equity return in Pakistan equity market by using Fama and French methodology. Their findings indicated that return is higher for value stock than growth stock and also higher for small capitalization stock. Nawazish (2008) evaluated the applicability of FF three factor model in Karachi stock market (KSE), and found that three factor model describe the stock return variations. Ang and Chen's (2005) proofed that CAPM is helpful in explaining the value premium in USA in period of 1926-1963.They suggested that in USA value socks earns higher profits in comparison to growth stocks. Drew and Veeraraghavan (2003) investigate the performance of model for four emerging markets (Philippines, Malaysia, Korea, and Hong Kong) and found that value premium and size premium did hold in these markets..Beltratti and Di Tria (2002) checked the applicability of multifactor model in Italian stock markets from 1991 to 2000. They concluded that FF three factor models can do the best job in explaining risk and return. Connor and Senghal (2001) gave details of return's cross section in stock market by comparing CAPM and FF three factor model and investigate which model is best in explaining it. The authors concluded that FF model provides better explanation as compared to CAPM. Davis et al. (2000) extending the study of Daniel and Titman (1997) studied the average return and covariance and found that value premium in average stock returns is robust. Claessens et al. (1995) applied the FF model to study cross section of returns in emerging markets and found that in addition to beta, size factors have important implication in developing countries. Fama and French (1995) included economic aspect in explaining three factor model in which they related returns factors to earning shocks. They concluded that firms having high book to market values are lagging behind in profit making than the firms with low book to market values firms with. This finally affirmed that high book to market share's returns is Compensation for holding less profitable and riskier stocks. This result showed that HML and SMB are alternative for relative distress. Daniel and Titman (1997) studied the NYSE, NASDAQ, and AMEX stock markets, by using monthly data of July 1963-December 1993. Their results did not support the FF three factor model. They argued that investors prefer growth stocks over value stocks and also found no explanatory power of market beta factor for return variations.

3. Data and research methodology

In this study we check the performance of three factor model in four Asian stock markets (Karachi stock exchange (KSE), Bombay stock exchange (BSE), Dhaka stock exchange (DSE) and Colombo stock exchange (CSE). Sample period from January 1, 2003 to 30th Dec 2011 is included in this study. The sample consists of companies from all industrial sectors listed on KSE, BSE, DSE, and CSE. The econometric analysis to be performed in the study is based on the data of 60 firms from each of the four stock markets based on Nawazish (2008) "Size value premium in Karachi Stock Exchange"

3.1. Model specification

Mathematically, we can represent the three factor model as

$R_{it} = R_f + (R_m - R_f)\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t}$ *Where t* =1, 2, 3… T

Where expected return on stock is represented byR_{it}, market premium is represented by$(R_m - R_f)$.size premium is represented by *SMB* and value premium by *HML.* (β1t) is market risk sensitivity coefficient followed by $\beta_{2t}$and β_{3t} which are size and value risk sensitivity coefficient respectively.

In order to test FF three factor model, same traditional approach of multivariate regression will be used and above mentioned equation is transformed in to simple time series model is as under.

$ER_{it} = \alpha_i + RP\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} + \varepsilon_t$

WhereER_{it}=$R_{it} - R_f$symbolizefor the excess return on stock*i*, RP=$(R_m - R_f)$represents risk premium, α_i represents the intercept of regression equation representing non market return component, It was anticipated that if the model holds then α would be non significant. The above model represents FF three factor model for an individual stock but with minor changes it can be used to represent portfolios. This change in the model includes replacing security *i* with a portfolio of stocks *p*, now for portfolio the three factor model can take this form as follows:

$ER_{pt} = \alpha p + RP\beta_{1t} + (SMB)\beta_{2t} + (HML)\beta_{3t} + \varepsilon_t$

Where $ER_{pt} = R_{pt}$-$R_f$and R_{pt} is represented by $\sum_{i=1}^{N} w_i R_{it} - R_f$and weight of stocks in portfolio is represented by W *wh*ereas non market return component is represented by αp=$\sum_{i=1}^{N} \alpha_i w_i$, its average of all individual alphas.

Return for KSE, BSE, DSE and CSE are calculated using monthly closing stock prices. Government six month security yield is used as proxy for risk free rate in this research.

3.2. Calculation of variables

Market return, portfolio and monthly returns

The portfolio returns are weighted average returns of individual stocks. Their estimation is done as follows

$$R_{pt} = \sum_{i=1}^{N} w_i R_{it}$$

$$R_{it} = Ln\left(\frac{P_t}{P_t - 1}\right)$$

Where closing prices are represented by P_t and P_t – 1 where P_t is the price on month t and Pt-1 is the price on month t-1.Then the portfolio return is obtained by weighted sum of individual portfolio.

Excess portfolio returns are estimated by portfolio and market returns.

SMB and HML factors and market premium

Market capitalization (price time's number of shares) is the criteria on which samples are ranked. Stocks were categories into two classes of Big (B) and Small (S). Taking 31st December of each year as reference point and dividing book value of equity to market by value, Book to Market (BM) ratio was calculated. After this three BM groups are constructed by categorizing the stocks in to Low (L), Medium (M) and High (H). Bottom 30%classified as Low (L), middle 40% classified as Medium (M) and top 30% classified as High (H). When two sizes and three book to market intercepts, six portfolios are formed. B/L, B/M, B/H, S/L, S/M and S/H are the above mentioned six portfolios. B/L portfolio contained stocks that were in big group and have low BM ratio whereas S/H portfolio contained stocks that were in small size group and high book to market ratio.

Size and book to market portfolios

Market premium was calculated by taking the difference as between return on KSE100 index, BSE 100 index, DSE, CSE all-share price index and the 6 month T bill yield. This market premium is similar as it was in CAPM however, FF three factor model do have two additional factors too namely SMB and HML. Market risk premium was estimated as follow.

RP=$(R_m - R_f)$

Risk premium related to share value is depicted by HML. Difference between the return on portfolio of high book to market ratio stocks and return on a portfolio of low book to market measures HML. It can be represented as follows.

$$HML = [S/H + B/H]/_2 - [S/L + B/L]/_2$$

Risk premium related to the size of firm is captured by SMB. It is measured by taking the difference of equal weighted average retunes of three portfolios with small cap and three big cap portfolios. Mathematically

$$SMB = [\frac{S}{L} + \frac{S}{M} + \frac{S}{H}]/_2 - [\frac{B}{L} + \frac{B}{M} + \frac{B}{H}]/_2$$

Following hypothesis are formed and tested keeping in view that it is simple multivariate regression frame work

$$H_1: \alpha_p \neq 0$$
$$H_2: \beta_{1t} \neq 0$$
$$H_3: \beta_{2t} \neq 0$$
$$H_4: \beta_{3t} \neq 0$$

In above mentioned hypothesis: $\alpha_P$stands for regression intercept while the risk sensitivities of returns are symbolized by β_{1t} ,$\beta_{2t} and \beta_{3t}$. if $\alpha_P$is significant, then FF three factor model will be valid.

Descriptive statistics

The monthly returns between January 2003 and December 2001 were computed on six sorted portfolios for four countries.

4. Empirical result analysis

Table 1: monthly returns

	KSE 100						BSE 100					
	SH	**SM**	**SL**	**BH**	**BM**	**BL**	**SH**	**SM**	**SL**	**BH**	**BM**	**BL**
Mean	2.15%	2.35%	1.49%	1.88%	2.35%	1.30%	2.97%	3.26%	4.66%	2.11%	3.24%	2.97%
Median	2.43%	2.26%	2.51%	1.74%	2.35%	0.86%	3.34%	4.02%	3.75%	2.24%	3.30%	1.94%
Maximum	24.09%	31.16%	29.17%	18.29%	52.40%	25.36%	31.52%	35.75%	158.38%	16.01%	38.70%	45.58%
Minimum	-26.40%	-24.64%	-33.29%	-27.27%	-34.09%	-41.85%	-18.59%	-30.29%	-29.69%	-13.84%	-24.81%	-27.80%
Std. Dev.	7.70%	8.81%	10.54%	6.62%	9.49%	10.33%	7.69%	9.36%	19.59%	5.73%	9.56%	11.29%
	DSE						**CSE**					
	SH	**SM**	**SL**	**BH**	**BM**	**BL**	**SH**	**SM**	**SL**	**BH**	**BM**	**BL**
Mean	1.19%	0.38%	0.49%	0.85%	0.70%	0.08%	2.82%	2.37%	2.60%	2.70%	2.42%	1.38%
Median	0.00%	0.00%	0.00%	0.85%	0.57%	0.00%	2.63%	2.46%	1.99%	2.66%	2.42%	1.24%
Maximum	21.43%	15.40%	21.53%	14.64%	12.60%	14.24%	34.88%	19.48%	27.43%	18.35%	18.17%	18.96%
Minimum	-37.08%	-28.44%	-32.20%	-22.61%	-23.28%	-14.50%	-23.06%	-26.80%	-31.86%	-12.25%	-24.19%	-27.58%
Std. Dev.	9.09%	6.57%	8.21%	5.96%	6.00%	5.67%	8.85%	7.84%	9.26%	6.03%	7.58%	7.37%

The descriptive statistics (Table 1) indicate that for KSE 100, BM portfolio offered the highest monthly return of 2.352% that is followed by 2.347% that has been offered by SM. The monthly standard deviations have been higher with maximum 9.491% of BM, and minimum 6.623% of BH.

For BSE 100 highest monthly return of 4.664% was offered by SL portfolio that was followed by 3.264% by SM portfolio. The standard deviations for BSE 100 have also been observed higher, with maximum 19.591% of SL and minimum 5.734% of BH.

For DSE Stocks, SH has offered the highest monthly return of 1.190% that is followed by 0.853% that has been offered by BH. The monthly standard deviations have been higher with maximum 9.090% of SH, and minimum 5.957% of BH.

In CSE SPI stocks highest monthly return of 2.822%, being SH returns that was followed by 2.700% of BH. Similar to KSE 100 and BSE 100, the CSE Stock return shows higher rates of standard deviation, with maximum 9.264% of SL and minimum 6.028% of BH.

These high rates of standard deviations for all portfolios are particularly due to their high risk profile of the sample stocks; and generally due to market situation.

Further tests were done where each portfolio is regressed against the FF model factors. Table 2 describes the findings of Fama ad French three factor model.

The results of the three factor shows that intercept is not be significantly different from zero and therefore the portfolios null hypotheses could not be rejected for the intercept.

Across all the markets and portfolios, except DSE, the existence of market risk premium along with size and value premium is well supported with R^2 ranging from 65% to 97%. The estimated coefficients are also encouraging for the existence of the three factors across all four markets this again follows the high t-values showing the existence of market risk premium in all the markets and portfolios, except DSE. The market risk premium also dominates other two factors across all the markets. The size factor is the second dominant across all markets; however, the size effect is most effective in small portfolios across all the four markets. The signs of coefficients for the four portfolios were mostly positive for small portfolio and negative for large portfolio confirming the size premium and consistent with the FF proposition. The value premium (HML) is the least dominate across all the four markets. Similarly, signs of coefficients for HML factor across the four portfolios was negative for low BM stocks (B/L) and was positive for high value stocks (B/H and S/H) demonstrating existence of value premium. The overall performance of model is robust for KSE, BSE and CSE and well supported by high R^2.

5. Conclusion

This study test the validity of FF three factor models in four Asia markets namely Karachi stock

market, Bombay stock market, Dhaka stock market, Colombo stock market. The stocks from these markets were observed and at the intersection of size and book to market ratio six portfolios were constructed. Results of this study were consistent with FF model but here in Asian markets beta was relevant in explaining returns only in one of the six portfolios. This empirical evidence suggests that FF three factor model is valid for these emerging markets and has ability to explain the return variations. The fund managers, investors and corporate managers can use this model as investment strategy for managing their portfolios and asset valuation.

Table 2: Three factor regression on portfolios sorted for size and book to market

	KSE 100					BSE 100				
	α	**β1**	**β2**	**β3**	**R2**	**α**	**β1**	**β2**	**β3**	**R2**
SH	0.01	0.87	0.67	0.55	0.79	0.02	1.02	0.64	0.44	0.84
	3.23	16.08	10.78	7.43615		5.75	21.93	7.08	7.93	
SM	0.02	0.88	0.70	-0.01	0.78	0.02	1.13	0.46	0.21	0.87
	4.06	13.78	9.49	-0.08		5.33	22.36	4.65	3.48	
SL	0.01	0.85	0.75	-0.65	0.89	0.02	0.62	1.41	-0.90	0.97
	3.59	16.02	12.31	-8.97		4.32	11.48	13.26	-13.93	
BH	0.01	0.75	-0.13	0.08	0.77	0.01	0.66	0.18	0.25	0.68
	4.32	15.30	-2.33	1.25		4.55	13.54	1.85	4.22	
BM	0.01	1.08	-0.54	0.53	0.70	0.02	1.05	-0.08	-0.09	0.92
	2.74	13.63	-5.97	4.86		7.12	25.53	-0.99	-1.85	
BL	0.01	0.77	-0.21	-0.71	0.87	0.02	1.06	-0.59	-0.41	0.91
	3.49	13.72	-3.18	-9.27		5.06	20.99	-5.97	-6.81	
	DSE					CSE				
	α	**β1**	**β2**	**β3**	**R2**	**A**	**β1**	**β2**	**β3**	**R2**
SH	0.02	-0.01	1.57	0.27	0.44	0.01	0.84	1.25	0.39	0.84
	(2.99)	(-0.69)	(8.57)	(1.879		(1.73)	(10.54)	(8.41)	(2.94)	
SM	0.02	-0.01	1.21	-0.45	0.36	0.00	0.75	0.68	0.01	0.80
	(3.55)	(-0.52)	(6.94)	(-3.32)		(0.66)	(11.64)	(5.60)	(0.07)	
SL	0.03	0.00	1.51	-0.97	0.53	0.01	0.89	1.11	-0.44	0.84
	(4.27)	(-0.23)	(8.60)	(-7.06)		(1.67)	(12.37)	(8.14)	(-3.67)	
BH	0.03	0.00	0.24	0.01	0.02	0.00	0.86	-0.19	0.55	0.70
	(4.33)	(-0.16)	(1.46)	(0.08)		(1.16)	(11.97)	(-1.40)	(4.64)	
BM	0.02	-0.01	0.74	-0.41	0.18	0.01	0.83	0.27	0.04	0.78
	(3.57)	(-0.61)	(3.87)	(-2.73)		(1.89)	(13.34)	(2.30)	(0.36)	
BL	0.02	-0.01	0.31	-0.75	0.25	0.00	0.80	-0.04	-0.63	0.65
	(2.92)	(-0.64)	(1.73)	(-5.43)		(1.36)	(10.85)	(-0.29)	(-5.18)	

Note: Figures in parenthesis indicate t-statistics. all values are rounded to 2 decimal places.

Lastly it must be added that asset pricing models are valuable for deducing economic rationale behind investment decisions but when they are used to analyze the human behavior, lot of problems occur. Financial economists have encountered problems whenever they have tried to model investor's psychology and the results for a particular time period might not be representative of actual investment behavior in subsequent time periods. This is due to uncertain future economic environment that causes the deviation between the theoretical models and practice, and the same could be the case with this research.

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