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Comparing CAPM and FAMA French for Predicting Stock Returns: New Evidence from Pakistan Stock Exchange

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Abstract- The aim of this study is to investigate return differences, accuracy and reliability of Capital Asset Pricing Mode (CAPM) and Fama-French Model for Pakistan Stock Exchange. A time series data set from January 3, 2014 to December 31, 2018 were used to analyze the yield spread estimates for 50 listed companies from KSE-100 list.. Most companies provide important evidence that demonstrates the impact of size factor and book value on earnings forecasts. According to the analysis, companies with lower book value ratios have better returns than companies with higher ratios.In addition, size factor shows that large companies' portfolios offer higher returns than small one. The additional factors of Fama-French model (size and value) provide more significant results than the single factor model. The study analyzedthat Fama French provides more accurate results for the Pakistan Stock Exchange as compare to CAPM. Therefore, Fama French model is suggested for yield measurement particularly forPakistan Stock Exchange.

Keywords: Portfolio, CAPM, Fama & French, Market Return, Size Premium, Value Premium, ExcessReturns

I. INTRODUCTION

Expected return estimate is the primary focus of financial decisions, such as capital planning or portfolio construction. Financial behavior suggests that investors tendto choose low-risk assets, mainly most investors are risk averters. Buying various insurance policies for hedging purpose,indicatestheir risk averting nature and theirreadiness to increase current insurance costs to avoid future uncertainty. Risk is considered to be one of the key factors in financial decision-making, and investors' interest in wealth maximization, can be achieved through sufficient knowledge of risk management. Poor investment decisions can affect companies' financial position and have a negative impact on its performances. Meanwhile, different efforts have been made for risks assessment and formulated in various forms. However, different models have diverse constraints that may produce contradictory outcomes, making investors confused about future cash flow.

Historically, for the first time Markowitz (1959) came up with an idea of portfolio diversificationtominimize risk at certain level of return on investment. The Markowitz's portfolio theory shows the importance of asset diversification for risk minimization. Later on, Sharpe (1964) introduced Capital Asset Pricing Model (CAPM)to measure required rate of return and was considered the most effective model in the 1960s and was in practice for a long time. The model was favored by its simplicity to estimate the expected return on financial assets.However, Basur (1977) exposed its limitations for the first time and realized that there is a close correlation between the expected return on equity and the price-earnings ratio. Meanwhile, Fama and Macbeth (1973) realized that the risk premium of CAPM securities was underestimated. This is followed by a new intervention by Fama and French (1992), which identifies two other important risk factors. It has been found that size of the firm majorly contributes when calculating the average difference between small and large stock portfolios. Similarly, value of firm also influence return on investment,considering that Fama French model is an extended form of CAPM with two additional variables.

Though the number of scientific studies prioritizes estimation of return on Fama and French models over the CAPM;however, Sharp's model is still preferred by practitioners in market as per its accuracy and simplicity [see Mishra and O'Brien (2018), Grauer and Janmaat (2010)]. Moreover, Bartholdy and Peare (2005) examinedthat the intercept of CAPMcovers size differences of the selected firms. However, this model poorly performed for those portfolios with large size. Therefore, this study attempts to determine the most applicable model in case of Pakistan Stock Exchange while comparing CAPM and French Fama.

This study will identify variable with high risk prediction power and would help investors for measuringinvestment return accurately.

Knowledge Gap

Since 1992, Fama-French challenged CAPM accuracy and opened a door for comparative analysis.As long as various studies in different economies areconducted[see Paulo(2013), Lambert and Hübner (2014), Chaudhary (2017)] however, these studies came up with no consensus. Meanwhile, the performance of both models were investigated in Pakistan as well [see Shah et al.(2014), Rehman and Baloch(2016), Fatima and Haroon (2018)]yet, less importance is given to portfolios construction technique as most of these studies construct the portfolios with simple difference method forsize and value, designing only two or three portfolios. Unlike others, this study constructed six different portfolios as suggested by Fama and French (1992) based on size and value differences.

II. LITERATURE REVIEW

In modern era of finance, one the key challenge is predictions of stock market uncertainty. Despite the considerable role of market regulators and influence of investors' decisions, the question is which risk factors should be used to assess for capital return. Sharp (1964)introduced the Capital Asset Pricing Model (CAMP), which illustrates positive linear relation between market beta and firms' risk premium. A single factor that explains the full risk premium is market beta, including all elements of systemic risk, to compensate for the opportunity cost of investors. However, CAPM was criticized by Banz (1981) and Reingnum (1983), as per its single factor and they recognized the size of the company another major factor that could affects return on assets. In addition, other researchers have recognized that CAPM produces significant intercept (alpha) term and low coefficients, which indicates specification error[Paulo Alves(2013), Acaravci and Karaomer (2017), Aggarwal (2017)]. The studies highlight under and overestimation problem of CAPM, as it produces uneven beta while dealing with high beta stocks. For instance, Alam and Baloch (2016) assessthe performance of CAPM when assessing Pakistan's mutual funds achievement. The data of 100 open-ended investment companies was analyzedto measured model efficiency. Regardless of size, highly cumulative intercept was produced by the model, not good for high performance portfolios.

Recent efforts by Fama and French (1996& 2006) referredtheir model as "real world application". In addition to the market premium Fama & France come-up with two other variables, the difference between the average yield of enormous and small companies, and secondly book to market value difference of high and low valued companies that further improved the accuracy of the return estimation. Although, the size and value premiums of Fama and French have gained great attention, but some recent studies have shown that value premiums may be misleading. Cremer *et al.* (2010) studied that value premiums in Fama and France being overvalued because the model's approach does not distinguish between the values effects of small and large portfolios. According to the study of Huij andVerbeek (2009) mimicking portfolios are considered in Fama & French model, that normally suffer from under-estimation and overestimation problems.

In order to reflect the expected return of a particular listed financial asset, CAPM is favored by practitioners for its convenience and simplicity. However, other scholars preferred to use Fama French because of accurate predictions. The study conducted by Attaullah *et al.* (2001) used consecutive five (2003 to 2007), forming various scale and value stocks. The results indicate that size and value coefficients remained insignificant for most portfolios. The study supported the CAPM overs Fama French for reliable return estimation. Similarly, Shah*et al.* (2014) summarized empirical evidencesin support of Fama-French model, the study claimedcapital asset pricing model is analyzed and used by several researchers and it's the most favorableforPakistan Stock Exchange. The study found no signs of market value and size and evaluateddeveloped markets efficiently respond to circulating information while emerging market makes delay to respond relevant information. Sharpe and Litterman (2016) applied Gibbon Ross Shanken test for determining suitable model between two opposing models and prioritizes CAPM.Results of the study generated awful results fund value and size. Meanwhile, market factors of all portfolios remained most significant variable of the portfolio. In addition, Raie *et al.* (2011) concluded that CAPM makes more sense in predicting expected returns.

In comparison to CAPM Sayed *et al.* (2014) evaluated return explanatory power of three factor model 'Fama French' of Dhaka Stock Exchange. Tests show that all these three factors significantly contribute in shareholder returns'. Book-to-book ratio along with size of the company may explain large variation of the return. Similarly, Veysel Eraslan (2013) used the same model for Istanbul Stock Exchange (ISE) to analyze a total of nine portfolios of different value and size to determine the excess return of the portfolio. For a portfolio with large companies, the scale factor did not produce significant results, but it did clarify the difference between the returns of small and medium-sized portfolios. However, the value of the company is seen as an important factor in the measurement of return on investment.

Fernandez (2015) uses CAPM and Fama & French models to test the portfolio return accuracy on the New York Stock Exchange. The study analyzed Fama French outperformed CAPM in measuring the expected portfolio returns. However, the paper explains that the results depend on the structure of the portfolio. Similarly, Blanco (2012) conducted a study of the US market (NYSE), which selected data from July 1926 to January 2006. The empirical results show that a portfolio with a lower book value has a better return than a portfolio with a higher book-to-market ratio. On the other hand, Jiri Novak (2010) empirically tested the ability of various common risk factors (market premium, value and size) to predict shareholder returns. The results show that no single factor can significantly explain market returns, which is why they are uncertain as a common risk factor in different business environments.

III. METHODOLOGY

The study is focusedto achieve its goalusing secondary data of Pakistan Stock Exchange (PSX). An attempt is made to examine the difference in return estimation of the three-factor model"Fama-French"and CAPM. The monthly returns of the fifty selected companies were considered for the study to analyze both models.. The monthly prices were sourced for the data portal of PSX over the period of five years and returns were measured on monthly basis.Followed by grouping all fifty companies in small, medium and high class as per the size and value characteristics. Subsequently, six main portfolios were constructed as per Fama-French technique.Finally, all six portfolios are aggregated and the R^2 value is considered a key factor in analyzing the results.

Data Descriptions

Secondary data from the Pakistan Stock Exchange was collected and analyzed using statistical tools. In the first phase, all 100 companies data was collected and identified specific companies who retained their data for all sixty months (five years) were highlighted over the period ofJanuary 2014 to December 2018. In next phase, fifty companies were selected at random from the remainingafter first scrutiny. For each model, return on the individual portfolio is calculated separately, with each portfolio being interpreted based on size and value categories and their outcomes.

Model of the Study

Investors must receive rewards based on risky assets that match the return on riskfree assets and the additional risk taken for the investment, Sharp (1964)model this theory as follows:

$$\Re_i = \Re F + (\mathrm{E}\Re_M - \Re f)\beta_i$$

Where:

$\Re_i$ *= return required on investment "i"*

$\mathrm{E}\Re_M - \Re f$ *= market premium*

β_i *= beta coefficient*

Here the risk premiumis considered as a main factor to measure excess return. However, Fama French came-up with two additional factors i.e. the average return offered by small size firms less return of large companies and the value factor, which represents the average return of a high value campany minus the average return of a growing company, modeled as below:

$$\Re_i = \Re F + (\mathrm{E}\Re_M - \Re f)\beta_i + (SML_t)\beta_j + (HML_t)\beta_k$$

Where:

SML *= Small minus Big*

HML *= High minus Low*

IV. EMPIRICAL RESULTS

Descriptive statistics for individual portfolios were evaluated prior to the analysis of the final model. The following table contains a complete descriptive summary of all six portfolios. In the table below, *, ** & *** represents 99%, 95% and 90% acceptance range respectively.

	Size Based Portfolios (50 Firms)									
	Mean	**MEDIAN**	**SD**	**SKW**	**KU**	**JB**	**ADF**	**PP**	**LQ(12)**	**LQ^2(12)**
S/L	0.055	0.015	0.196	1.359	5.029	28.777	-1.183*	-1.183*	165.310*	352.840*
S/M	0.039	0.011	0.185	4.330	27.271	1660.26	-0.911*	-0.911*	170.120*	310.100*
S/H	0.059	0.039	0.202	3.991	20.440	919.738	-1.065*	-1.065*	140.190*	259.320*
B/L	0.017	0.003	0.063	1.217	5.420	29.485	-1.144*	-1.144*	31.245*	173.520*
B/M	0.017	0.000	0.078	0.880	3.758	9.182	-1.104*	-1.104*	72.607*	198.140*
B/H	0.239	-0.006	1.867	6.387	46.052	5041.87	-1.040*	-1.040*	53.571*	122.950*

Table 1: Descriptive statistics of all selected firm, which are formed in six portfolios.

The average of all companies in the above table is still positive, indicating that each portfolio achieved at least above zero return. Moreover, the highest return is achieved by the last B / H in a total of six portfolios which is almost 24%.

CAPM and Fama French Cumulative results

From January 2014 to December 2018, monthly returns were calculated for six selected portfolios. The returns of each individual portfolio are measured and the interpreted one by one. As a final point, the R^2 values (key factor) of all six portfolios are compared across the portfolios. The following table shows the combined results of all six CAPM portfolios in which the coefficient values can be comparatively analyzed. The below table shows comprehensively about all of six portfolios starting from Small/Low to Big/High respectively.

In the regression, the excess return of the firm'I' represents a risk premium associated with the market portfolio (Rm-Rf). However, error term (εi) represents the unexplained part of the return that varies because of other then selected factors and Alpha (α) represents the constant part of the model.

	Portfolios	**Alpha**	**Rm –Rf**	**t-stats**	**Pvalue**	**Rsquare**
A	Small/Low	0.043	0.969	1.788	0.078	0.053
B	Small/Medium	0.032	0.808	1.567	0.121	0.041
C	Small/High	0.061	-0.271	-0.474	0.636	0.004
D	Big/Low	0.009	0.739	4.829	0.001	0.287
E	Big/Medium	0.009	0.783	4.025	0.001	0.219
F	Big/High	0.265	-2.181	-0.414	0.679	0.003

Table 2: CAPM results for all six Portfolios

At first, monthly returns were measured for all six portfolios from A to F, arranged in order from small to large. The last portfolio (big to high) achieved higher return that is around 24%, higher than all other five portfolios (as described in 4.1 table). The column titled "Alpha" represents a constant value for each portfolio and typically measures the partial yield of the portfolio excluding market risk factor, and its value remained low as 0.008 for portfolios D and E, while highest for portfolio F. The second column measures the beta coefficients of each portfolio, which are negative for C and F. This shows the inverse relationship between the market risk and the respective portfolio, but it could be neglectedas per it insignificant P-values.

The significance of beta value could be verified with P-value and t-statistic, which are significantin the above case for three portfolios A, D and E, while the remaining three are insignificant. The explanatory power of R^2 is considered to be the main tool for analyzing the results differences and explains the overall variation of the dependent side of the model because of explanatory variables. For the above six portfolios

of CAPM, portfolios D and E have 28% and 22% R^2 value respectively, while portfolio A offers only 4% return and the remaining three are insignificant in case of CAPM.

	Portfolios	A	SMB	HML	RM-RF	P(β1)	P(β2)	P(β3)	R.Sqr
A	Small to Low	0.039	0.155	0.092	1.049	0.408	0.476	0.068	0.067
B	Small to Medium	0.004	0.659	0.426	1.218	0.000	0.000	0.011	0.280
C	Small to High	0.004	1.263	0.849	0.587	0.000	0.000	0.070	0.720
D	Big to Low	0.006	0.053	0.034	0.772	0.312	0.342	0.000	0.300
E	Big to Medium	0.004	0.093	0.064	0.850	0.163	0.164	0.000	0.245
F	Big to High	0.042	-1.041	1.286	1.235	0.000	0.000	0.035	0.988

Table 3: Fama & French Results for all six Portfolios

In Fama & French regression model, above six portfolios shows different values corresponding to their coefficients. For most portfolios in the table above, the alpha/intercept appears insignificant. The following column ratify the size factor that remains different for all the selected portfolios while its maximum value appears for portfolio 'C' which is 1.263. Meanwhile, the negative sign points to the inverse impact of the size factor. However, size factor remained significant only for the portfolios 'B', 'C' and 'E', while for the rest of three size is not significant. The HML in the table above illustrate the value impact. For portfolio 'E', the highest value of HML appears in above table i.e. 1.28. The beta factor of the next column is significant for all visible portfolios as itsP-values remained significant. The higher contribution of the market risk premium to the portfolio return shown by portfolio F, B and A, respectively. Finally, the last column R^2 is considered to be the most important measure for the differences of Fama French and CAPM. Its value remained higher for portfolio F followed by C and then B, which is 0.98, 0.72 and 0.28 respectively. The R^2value of the above two portfolios is very high and three of them (B, D & E) have a modest value, but only one portfolio has a low R^2..Resultantly, R^2 values of Fama French remained higher as compare to CAPM, however, only one portfolio produced low R^2 value in comparison to capital asset pricing model.

V. DISCUSSION

Aim of the study was to analyze the performance of CAPM and Fama French in Pakistan Stock Exchange. Sharp (1964) suggested only one factor (risk premium) to describe excess return of a stock or a portfolio. later on, Fama French (1992) claimed that size and the market value premium are also significant factors and can increase the significance of previous model. Results of their study confirmed the alternate hypothesis and the two models (CAPM & Fama French) produced significantly different results while estimating portfolios return. The results of this study confirmed that Fama French has achieved more significant resultsas compare to CAPM in case of PSX. The produced results of this study are matching with Azam *et al.* (2011) study, which compared the models predictability. Theyanalyzed KSE-100 data from January 2003 to December 2007 and found significant differences in the performance of the single-factor and three-factor models.Similar study was conducted for Dhaka Stock Exchange by Sayed *et al.* (2013), who compared the explanatory power of both models over the period of 2010-2012. Results showed significant effect of all three factors on shareholder returns. Alone market premium can't explain overall variation in return, size of the company and book-to-market ratio explains major part of it. Moreover, results of our study are partially similar to a study conducted by Veysel Eraslan (2013) on the Istanbul Stock Exchange (ISE) from 2003 to 2010, using monthly data of excess returns. The study formed nine portfolios to investigate size and value effects, and noticed that portfolios with greater firm valueoffered higher average returns than portfolios with low valued firms. However, the size factor was found insignificant for ISE.

Meanwhile, proposed results of this study contradict with Alam and Baloch (2016), who assess Pakistan's mutual fund performance using these models. Both models were reviewed for 100 open-ended Pakistan investment funds. The CAPMprovided good results for all portfolios as it was claimed that the intercept of the model covers cumulative effect of size and value. However,addition factors of Fama-French model were found unfit and market premium as claimed significant for all portfolios. The study claimed that CAPM is one of the favorable models while measuring mutual funds performance in Pakistan.

VI. Conclusion

Fama and French (1992) argued that size of the firm and market capitalization may account for the majority of changes in the portfolio's average yield. They support their argument that CAPM produces larger price error (alpha), that remains three to five times greater than one produced by Fama & France's model. So, the main purpose of this study was to analyze similarities and differences in return estimation of CAPM and the Fama and French three-factor model in case of Pakistan. Fifty listed firms' data was collected from Pakistan Stock Exchange over the period of fiveyears, starting from 2014 to 2018.

Both models were used to consider and evaluate six portfolios of selected companies based on different scales. The R-square value remained a key factor to analyzed performance differences of the models. Although the CAPM model has been found to be simple in practice, however, size and value of the company increases the explanatory power of the model. Therefore, Fama French has achieved better results than CAPM. In addition, this difference is especially important for portfolios; small to high and large to high, which produced 0.72 and 0.98R-square values respectively.

Meanwhile, the study only considered simple CAPM, which assumes that portfolio selection is primarily based on return distribution of mean and variance. However, other complex forms of CAPM, namely conditional CAMP and cross-time CAPM can be analyzedin further studies. In addition, it is recommended that future studies use weekly and daily basic data to investigate new risk factors such as the ratio of earning to price, cash flow to price ratio, dividend yield and historical sales growth.

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