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DETERMINATION OF STOCK RETURNS USING FIVE-FACTOR CAPM: EVIDENCE FROM PSX

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ABSTRACT

Stock returns indicate variations in future economic activity but literature is inconclusive in defining this relationship. To elucidate this relationship, the study empirically analyzes the impact of stock returns using the Capita Pricing Model (CAPM). Data is accessed from the Pakistan Stock Exchange (PSX) monetary sector for 2002-2017. Premium, Book-to-Market value (BMV), investment, size, and market value were taken as the predictors of Stock Returns. Panel regression analyses were used to estimate the relationship between the observed variables. For further analysis, the random and fixed model analysis was applied. In comparison with random and fixed models, it was observed that the fixed model has the least preference over the random model, so the fixed model analysis was opted to estimate the stock returns. It was observed that the fixed effect model should be preferred over the random effect model to estimate the stock returns. Empirical results revealed that there was a progressive and statistically significant relation among premium, size, investment, and profitability on stocks while BMV had positive but inconsequential relation with stocks. This study also clinched that Fama and French five factors are the best predictors of stock returns of financial firms in the Pakistani context.

Disciplinary: Management and Financial Science.

1. INTRODUCTION

In recent years, there are apparent new stock markets that are big and globally diversified. From time to time returns offered by these markets attract the investors/ shareholders and the researchers of the finance around the world. Many models are explained by the researchers to select the portfolio for minimizing the risk of returns. The capital asset pricing modal (CAPM) which is based on asset pricing theory (apt) developed by Linter (1965), Sharpe (1964) and Mossin (1966). Although, this model was developed many decades ago, but with the new modifications, the CAPM is still widely used. Fama and French (2004) use the CAPM because it gives the intuitions about the risk and return

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of emerging/new stock markets. Fama and French (2004) contribute the two factors size and Book-to-Market Value (BMV) to improve the deficiency of the single CAPM. But there was still incomplete information/knowledge related to returns on the stock market.

Different models were pioneered by different authors. These models were divided into a dynamic and static model. The latter model includes CAPM models as discussed by Sharpe Lintner model (1964), Black Zero beta model (1972), Mayers model (1974), Breeden model (1979), International model by Solnik (1974), Adler and Dumas (1983), APT by Ross (1976), three-factor model of Fama and French (1993) and three moment model by Rubinsten (1973). The five-factor model was discussed by Fang and Lai (1997) and DIttmar (1999). The dynamic model includes the International model (Merton 1973), the Consumption model by Breedan (1979), production-based model by Lucas (1978) and Brock (1979) Investment based model by Cochrame (1991), Liquidity based model by Acharya and Pedersan (2005), Conditional model by Jagannathan and Wang (1996) while Fama and French (1993;1997) Momentum model of three factors.

A new model of CAPM was devised by Fama and French in (1993). The traditionally CAPM model has used only a single variable to mention the return on stocks. Also, Fama and French in 1993 introduced a three-factor model by including two more factors in the standard CAPM. These two factors included for the two classes small-cap and stock with low B/P.

$$R_{it} - R_f = \beta_0 + B_1(R_m - R_f)_{it} + \beta_2 SMB_{it} + \beta_3 HML_{it} + \varepsilon_{it} \qquad (1).$$

Equation (1), β_2 is associated with small minus bing and β_3 is associated with high minus low for stock returns of the CAPM model. Both β_2 and β_3 have been determined for the regression line and can have positive or negative values. Griffin (2002) challenged the model of CAPM proposed by Fama and French in (1993) and concluded that these factors should be specific to at country level, as there are a lot of local factors that required more explanation to estimate the stock returns through CAPM model.

But the three-factor model was just only the improvement in the three-factor model and it did not explain the anomalies nor the cross-sectional variation in stock returns (Fama and French 2004). To overcome this problem Fama and French (2014) devised a new model with 5 factors with the contribution of 2 more factors in the existing 3-factor model. These new factors are Premium, Size, BMV, Investment, and Profitability which are used to manipulate the risk on return for financial firms. Does this study check whether the components of the CAPM 5 Factor Model determine the returns on stock for financial firms in Pakistan or not?

The core purpose of this study is to measure the determinants of returns of stock for financial firms listed in the Pakistan Stock Exchange (PSX) using five-factor CAPM consisting of Premium, Size, BMV, Investment, and Profitability.

This study null hypotheses are

- H#1: Premium and Stock returns have no relationship.
- H#2: Size and Stock returns have no relationship.
- H#3: BMV and Stock returns have no relationship.
- H#4: Investment and Stock returns have no relationship.
- H#5: Profitability and Stock returns have no relationship.

2. LITURATURE REVIEW

Chen and Kawaguchi (2018) suggested the multifactor Asset Pricing Model (APM) in the context of the Chinese Stock Exchange market and devised under the regime of Markov. Chinese stock exchange market had two regimes; in its 1st regime, the risk premium was higher as the author considered for aversion level with the condition of high risk. Fama and French (1993) 3-factor model provided a positive risk-return while on the other side in 2nd regime the premium with low returns was detected having low BMV and large size of the firm. The results showed that the best and value stocks were much uncertain in a bull market.

Agarwal (2014) proved how to obtain a higher return with low volatility with the background of the Bombay Stock Exchange (BSE), using risk-weighted alpha (RWA) to show the sTable increasing return with a low level of volatility. Top 30 stocks by market capitalization were taken to test the volatility. Increasing return and lower volatility showed by stock like Hindustan. RWA and BSE index maintaining the beta the same as in the BSE Sensex Index.

The relationship between stock returns and beta portfolios for the Turkish Stock Exchange was anticipated by Terregrossa and Eraslan (2016). This was the first study as in history and literature of financial firms, no one described the relation between beta and portfolio returns. These researchers found a systematic relationship between betas and portfolio returns and name them as a security market plan. This notion was termed as SMP. Later it was proved that SMP was a successful model that accurately measured the stock returns and provided new insights to avail opportunities and to make decisions for portfolio investments.

Kim (2016) proposed a J-shaped relationship between dividend and value of the firm. Top dividend payers' firms also had higher value on the contra-side non-dividend payer firms had lower value. But by using the j-shaped relationship, it found significant results for 1962-2010, after controlling the characteristics of firms such as profitability, growth and size. Dividend theories such as free cash flow, catering is inadequate to explain the j-shaped relation (Afzal, 2020).

Jiang (2016) observed the dividend payments and liquidity of listed firms from 2000-2014 in the Chinese Stock Exchange and found a significant relationship among stock dividend payments and liquidity of stocks. But stock liquidity only showed the liquidity information and increase incentives to pay a dividend to shareholders. The author found a positive relationship between stock liquidity and dividend payout but only when the environment opaque. The dividend payout was favorable for those who had low stock liquidity. It was concluded that there were several conditions such as government, non-controlling block holders, and manager-shareholders agency conflict that lead to stock liquidity.

Banerjee et al. (2014) checked the four-factor model in the context of the Indian Stock Exchange market. In the Fama and French 3 factor model, the 4th-factor momentum was added to see the impact on returns of the stock market. In their study, Firm Size, BMV, Premium, and Momentum were used as independent variables. The findings expressed that the 3-factor model of Fama and French had a significant impact but the fourth-factor momentum used by researchers was negligible because it had no significant impact on the study.

Agarwalla et al. (2014) checked the effect of the Fama and French 3 factor model and Momentum factor on the Stock Returns in the context of the Indian Equities Market. Data collected

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from the online data library for 1994-2014. The Average Returns on the base of the momentum factor was 21.9 %. A portfolio can make on the percentage of B/M, Size, and Premium. The B/M percentage was 15.3%, the size was 0% and the premium was 11.5%.

Shaker and Eligiziry (2014) compared the asset pricing model in the stock of Egyptian. GRS test applied to compare the five different models of asset pricing. Data collected from the EGX100. The CAPM, FF3F, CFF, liquidity 4-factor model, 5-factor model (liquidity and momentum included in the three-factor). On the base of the given 2003-2007 data from six portfolios were made. The size and BE/ME ratio considered best for the portfolio. The findings confirmed that the FF3F model best for average returns from 2003-2007. Fama and French three-factor model has superiority over the CAPM. The Cahart 4 factor model did not apply to the Egyptian market. The liquidity model also had a deficiency due to turnover. Results of FF3F more appropriate compared to all other models.

Maxim (2014) evaluated the CAPM three-factor model and APT at the Romanian capital market. The sample was taken for 2006-2013 of 25 companies listed on the Bucharest Stock Exchange. Six models were investigated to select the best for the Romanian Capital Market. The CAPM two factors, downside-CAPM, 3- and 5-factor models of Fama and French where the theory of Arbitrage pricing was used. The results concluded that for the Romanian capital market Fama and French 5 factor model was the best performing model because it better explained the returns.

Blanco (2012) used the CAPM and Fama and French 3 factor model for the portfolio selection. The study used data of the American NYSE market. The selection of portfolio depends on the size and BMV, using 1926-2006 data with Cross Section Regression and Time Series Regression. Sample data based on two factors expected returns and Fama and French model factors. The results disclosed the significance of statistics and R square value.

Mwall and Karasneh (2011) used the Fama and French 3 factor model in the context of an emerging market to explain the variation in stocks for 1999-2010. The study checked the assurance of size and BMV. The procedure made at two stages firstly selects the independent variable and then dependent variables (portfolios). OLS was used in the study to show the relationship between variables. The results showed that size has a strong positive impact on ASE. The 3-factor model of Fama and French provides better results as compared to the single factor model of CAPM.

Hou et al, (2011) investigated the Global Stock Returns and identified the important factors, using monthly returns for 27000 stocks from 49 countries. The multifactor model includes momentum, cash flow to price, and two variables of CAPM size and BMV. Findings showed that local and international descriptions of these observations have a lower price as compared to a global and emerging market. Market, consumer prices, and factor for momentum gave the lowest pricing error and least chance for rejection of model. But there were many firms' characteristics that have not been considered such as liquidity, issues in stock investment, and growth in assets. The studied authors reject the characteristics and find reliable results related to global cash flow to price.

Johnson at al., (2010) examined the endogenous leverage and expected stock returns. This paper described under which conditions leverage had a negative relationship with anticipated stock returns. This paper investigates the previous model of George and Hwang (2009) asserts the structure of capital by firms in different default risk cases. Variation cannot control the book-to-market ratio but may lead to desired relations expected excess return, market debt, and book equity examined. Variation in taxes and firms' duration negatively associated with stock returns. Asset characteristics

also considered while making expectations about the expected stock return. There was a negative relationship between risk and profitability and expected return with leverage and a positive relationship with Book-to-Market.

3. METHOD

This study model is

$$R_{it} = \beta_0 + B_1 PRE_{it} + \beta_2 SIZE_{it} + \beta_3 BMV_{it} + \beta_4 Inv_{it} + \beta_5 P_{it} + \varepsilon_{it} \quad (2),$$

where i denotes the firm ($i = 1,2 \ldots n$) and t denotes time

PRE_{it}= Premium (R_m-R_f) of i^{th} firm in t^{th} year

$SIZE_{it}$= Show the Market Capitalization of i^{th} firm in t^{th} year

BMV_{it}= Book-to-Market Value of i^{th} firm in t^{th} year

Inv_{it}= Investment of i^{th} firm in t^{th} year

P_{it}= Profitability of i^{th} firm in t^{th} year

ε_{it} = Error term of "i^{th} "firm in t^{th} year

R_{it} = stock returns of i^{th} firm in t^{th} year

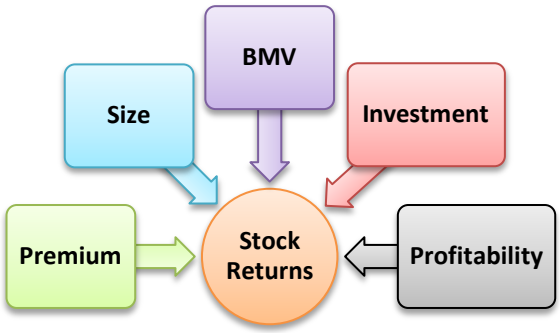

Figure 1: Study Framework

The stock return is the dependent variable while Premium, Size, Investment, Profitability, and BMV are the independent variables of this study (Figure 1). For the calculation of stock returns yearly amount of dividend value is used. To calculate the value of premium (PRE), the risk-free return is subtracted from the stocks of the market. T bills value is used to measure the risk-free return. Firm size (market capitalization) was calculated by multiplying the market price per share with outstanding shares. BMV was calculated by dividing the share price and book value per share. Investment (Inv) was the total number of assets held at the end of that specific year. Profitability (P) value gets by the value of earning per share (EPS).

Panel data with cross-sectional surveys were used in the study. Panel data has the advantage that there is space as well as dimension. Hausman test with a fixed effect is used in this study for measurement and to verify the assumptions. Panel data can be related to the firms, states, countries, or individuals. The procedure for selecting panel data depends on the individual-specific variables of interest. Panel data in a combination of time series was utilized. This cross-sectional is more informative, more reliable, and more effective. Panel data can better perceive the effect of variables that are not correctly measured as a single unit in cross-sectional and time-series data. Based on the

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above advantages, this study utilizes panel data.

The study uses the determinants of stock returns by considering the variables of premium, size, book market value, investment, and profitability in the Pakistan Stock Exchange (PSX) using annual data for 2002-2017. Four hundred and twenty-eight financial firms listed in PSX are selected as a sample in this study. Firms are selected under the sector of commercial and investment banks, modaraba, leasing, and insurance companies. Data is retrieved from the official website of State Bank of Pakistan (SBP).

4. RESULT AND DISCUSSION

This study finds the determinants of stock returns by adopting the capital asset pricing model in the context of Pakistan. To solve the purpose, the study utilized the Panel Regression Analysis to check the data. For analysis, Descriptive statistics, fixed effect model, Hausman test, and random effect model are used.

4.1 DESCRIPTIVE STATISTICS

Descriptive statistics summarize and quantify all the coefficients of the data for given values in the data. The prime aim of such statistics is to measure the central tendency and the level of dispersion in the data. Table 1 measures the central tendency through Mean and Median while dispersion is measured with SD.

Table 1: Descriptive Statistics

Measure	RETURNS	RISK(PRE)	SIZE	BMV	INV	PROF
Central Tendency	1.55	-15.62	22.03	55.12	157.42	4.02
Middle Value	0.84	-0.22	5.76	24.48	20.19	2.12
Highest	16.00	155.07	341.69	620.32	1867.00	104.48
Lowest	0.00	-7310.21	0.00	-139.74	0.00	-4.27
SD	2.21	353.96	45.00	84.51	284.71	8.43
Jarque-bera	1945.20	3182242	5440.33	3282.86	2132.68	75169.33
p-value	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table 1 shows the Descriptive statistics of stock returns, premium, size, BMV, investment and profitability. The calculated value of the central tendency for returns on the stock is 1.5. This shows a huge difference between the highest and lowest values of stock and it is concluded that firms are giving low profits in the forms of dividends to the investors. The central value can be easily affected by extreme values so it is good to judge the results from medians or the middlemost values. The median or middlemost value of returns on the stock is 0.85 which confirms our stance that the investors are being given low dividends. The median value has more worth because it is not affected by the extreme values but the problem is that it does not count all the values from stock returns. For premium or risk, the value of the central tendency is -15.619. By ignoring the negative sign, it is concluded that all financial firms are operating under high risk. However, the lower value of the median shows that these risks are moderate and can be handled. The size of firms has values ranging from 22 to 10 with a central value of 15. It shows that firms have low variations in their sizes with more than 50 percent of the firms comes under the heading of smaller firms while other comes under the heading of larger firms. However, the trends in data showed the skewness in firm size. Values of BMV for mean and median are 55 and 24 respectively. Both of these values are not close to the highest and lowest values and SD is also high. The values of BMV also show a high level of skewness

in the data. The values of investment are 157 and 20 for the central and middlemost values. The difference between both values also confirms the skewness in the data. Form these values it can be concluded that investment patterns are not normal and investors invest in the stocks seasonally. In the last, the values of profitability are 4 and 2 respectively. These values show that financial firms are not earning good profits. This is because of the variations in firm size, operating in a high-risk environment, and haphazard investment patterns. Thus, it is concluded that financial firms operating in the listing of PSX are not earning reasonable profits which ultimately affect the returns on stock values.

4.2 CORRELATED RANDOM EFFECT-HAUSMAN TEST

The simple regression model is assumed between the dependent and independent variables. For the analysis, the models of random effect and fixed effect were used. The results of the random effect model given in Table 2, it can be observed that the calculated value of the Hausman test for chi-square is 56.15 while the p-value is <0.01 which is less than the alpha value set as 0.05. So, the model of the fixed test is more suitable for analysis.

Table 2: Model of Random Effect

TEST SUMMARY	CHI.SQUARE	CHI.SQ D.F	p-value
Cross Section Random	56.15	5	<0.01

4.3 FIXED EFFECT MODEL

Results of the model of fixed effect are given in Tables 3 and 4. Table 3 shows that the value of R^2 is 0.76, it means seventy-six percent variation in the dependent variable i.e. returns on the stock has been explained by the independent variables of investment, size, BMV, premium, and profitability while remaining 24% of the variation is due to those factors which have not been considered in this study. F-statistic and its p-value indicate that the suggested model is significant for returns on the stock with predictors of investment, size, BMV, Risk or premium, and profitability.

Table 3: Analysis of variance

R^2	0.76	Central Tendency	1.55
Adjusted R^2	0.73	SD	2.22
Standard Error	1.14	Akaike info criterion	3.21
Residuals	498.79	Schwarz criterion	3.66
Log	-640.06	Hannan-Quinn criterion	3.39
F Value	26.46	Durbin-Watson	1.10
P Value	<0.01		

Table 4: Panel Regression Analysis

VARIABLES	COEFFICIENT	STD.ERROR	T-STATISTICS	PROB
PREMIUM	-0.01	0.12	0.60	0.04**
SIZE	0.02	0.01	7.06	0.00***
BMV	0.00	0.01	0.62	0.54
INVESTMENT	0.01	0.01	9.94	0.00***
PROFITABILITY	0.02	0.01	2.45	0.02**
C	0.07	0.12	0.60	0.55

, * show the 5% and 1% level of significance respectively

Table 4 shows the results of the panel regression analysis. The value of t-statistics and p values

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for premium, size, investment, and profitability indicates that these variables are significant and BMV is non-significant as its p-value is greater than 5% (0.54). Based on the calculated values, it is concluded that stock returns have a substantial and positive relationship with premium, size, investment and profitability. Contrary, based on t-static and the value of probability for the coefficient of BMV, it is concluded that there is a positive and insignificant relationship between stock returns and BMV.

This study was aimed to measure the causes of the increase in stock returns in the context of Pakistan stock exchange. Panel data with Regression analysis was used to analyze the returns on a stock by using a five-factor model of Fama and French (2014) including premium, size, book market value, investment, and profitability using data for 2002-2017 and forty-two financial firms annual data. Based on the Hausman test statistic value which is less than ten percent, it was concluded that fixed models are preferable to measure the stock returns in Pakistan. Based on the t-statistic coefficient value in Table 4, H#1 was rejected and decided that stock returns and premium have positive and significant relationships with each other. The value of probability for the coefficient of firm size is less than one percent. Based on this value, we rejected H#2 and decided that stock returns and size have positive and significant relationships with each other. The value of probability for the coefficient of BMV is not less than the one percent so we accept H#3 and decided that stock returns and BMV have positive but insignificant relationships with each other. The p-value for investment is less than the one percent in Table 4, so based on this value, we reject H#4 and that stock returns and investment have positive and significant relationships with each other. The p-value for profitability is also less than the one percent in Table 4, so we reject H#5 and concluded stock returns and profitability have a positive and significant relationship with each other.

5. CONCLUSION

With five-factor CAPM, the results indicated that size, premiums, investment, and profitability are the major determinants of the stock returns in Pakistan. Seventy-six percent variations in the stock returns in Pakistan are due to premium, size, book market value, profitability, investment. Our results also confirm that Fama and French (2014) model factors are the major contributing factors of stock returns in Pakistan.

6. AVAILABILITY OF DATA AND MATERIAL

Data can be made available by contacting the corresponding author.

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