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Size and Value Premium in Karachi Stock Exchange

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Abstract

The current study evaluates the performance of Fama and French Three Factor model in Karachi Stock Exchange (KSE). We employed multivariate regression approach after sorting six portfolios on size and book to market. The constituent stocks were selected to represent each and every sector of KSE. Daily returns were employed for a period of five years starting from January 2003 to December 2007. The excess returns for each portfolio were regressed on market, size and value factors. The results were encouraging for the three factor model. The three factor model was able to explain the variations in returns for most of the portfolios and the results remain consistent when the sample was reduced to control for size effect. Our findings are consistent with most of the studies that suggested the validity of three factor model in emerging markets.

JEL Classification: G11, G12, G14

Keywords: Size Premium, Value Premium, Market Premium, Three Factor Model.

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I. Introduction

Fama and French (FF) three factor model has emerged as an alternative explanation for the ongoing arguments on asset pricing. FF started with the observation that two classes of stocks have performed better than the market as a whole. These included stocks with small market capitalization and stocks with high book to price (market value). Since these stocks yielded higher return than market, FF commented that such phenomenon is explained by the existence of ***size*** as well as ***value*** premium in addition to the market risk premium as posited by traditional CAPM.

To account for these two premiums, FF constructed two more risk factors outside of market risk. They used *SMB* (small minus big) to address size risk and *HML* (high minus low) for value risk. The high book to market ratio stocks are termed as value stocks while low book to market stocks are growth stocks. The size factor measures the additional returns investors receive for participating in stocks with comparatively small capitalization. The positive *SMB* factor represents more returns for small cap stocks vis-à-vis big stocks and vice versa. The value factor captures the premium investors will get while investing in stocks with high book to market ratio. A positive *HML* signifies more returns for value stocks than growth stocks.

The three factor model can be expressed as follows

$$R_{it} = R_f + (R_{mt} - R_f)b_{1t} + (SMB)b_{2t} + (HML)b_{3t}$$

Where R_{it} represents expected return on stock *i*, $R_{mt} - R_f$ represents market premium, *SMB* is the size premium and *HML* represents value premium. The coefficients are the risk sensitivities for market risk (β_{1t}) followed by size (β_{2t}) and value (β_{3t}). The market risk coefficient is akin to Sharpe's CAPM but different in the sense that in three factor model explanatory function will be shared by two other risk factors.

FF three factor model has emerged as an alternative explanation for the ongoing arguments on asset pricing. The discrepancies in CAPM have contributed towards the success of alternative explanations. Fama and French (1998) advocate a global version of their model. They studied thirteen world markets during 1975 – 1995 and showed that value stocks have a tendency of higher returns than growth stocks. They sorted the portfolios on book to market ratio and in twelve out of thirteen countries, value stocks out performed growth stocks. Similar results were observed for emerging markets. They commented that an international CAPM did not explain value premium in international markets.

Although the framework of FF is simple but, as mentioned earlier, considerable empirical controversy exists about the interpretation of their risk factors. Some of the researchers have proposed that the existence of book to market premium is not due to investors' compensation for risk bearing rather it could be because of investor overreaction [Lakonishok, Shleifer, and Vishny (1994), Haugen (1995)]. They suggest that investors overreact to corporate news and exaggerate their estimates about future growth. Consequently, the value stocks tend to be under priced while growth stocks tend

to be over priced. Another group of critics relates the success of FF model to the empirical gimmicks [Ferson, Sarkissian, and Simin (1999)]. They suggest that the explanatory power of three factor model is due to econometric regularities. This could be due to inherent biases or data snooping that exaggerates the results for three factor model. Berk (1995) suggests that the way in which portfolios for high book to market and size are constructed, they are expected to yield high returns regardless of any economic interpretation.

Markets outside North America and Western Europe have grown rapidly in last couple of decades. A significant change in financial markets scene is the evolution of emerging markets where the potential for investment in terms of risk and return is reasonably high. International Finance Corporation (IFC) rates approximately 30 countries as emerging markets. In emerging economies the market dynamics and investment behavior is distinct. These economies have smaller financial markets in proportion to their economies size vis-à-vis developed markets. Other important aspects of emerging markets are the level of activity and their openness to foreign investors. In presence of thin trading, informational inefficiency, panics, bubbles and lack of transparency, the overall investor activity remains range bound to certain stocks [Li, Wei and Hoyer-Ellefsen, Richard (2004)]. These differentiating factors warrant an examination of the behavior of asset pricing in emerging markets. With monetary integration and globalization, investors tend to diversify their portfolios by participating in developed as well as emerging international markets Therefore, it is vital to analyze

the applicability of asset pricing models in an emerging scenario to support investment decisions.

Pakistan has been classified as an emerging market and the research literature on asset pricing is very rare in general and almost non existent about size and value premium. There are three stock exchanges[1] in Pakistan with KSE being the most liquid and biggest in terms of market capitalization and trading volume. KSE has been awarded the best performing emerging stock market of the world in 2002 by Business Week. Like all other markets the investments decisions are backed by some fundamental economic rationales or technical indicators. The aim of this paper is to study the power of FF three factors model to explain returns of KSE traded stocks. The outcome of the research will provide an insight about the capacity of FF three factors model to explain the puzzling risk return relationship in an emerging market.

The rest of the paper is organized as follows. Section II will summarize some of the existing literature on size and value premia. Section III will discuss the data and methodology. Empirical results are presented in Section IV and Section V will conclude.

[1] These include Karachi Stock Exchange (KSE), Lahore Stock Exchange (LSE) and Islamabad Stock Exchange (ISE).

II. Literature Review

Fama and French (1992) examined the cross section of stock returns and presented additional factors of size and value premium to clarify the return anomalies that CAPM was unable to explain. They used non financial firms data of NYSE, AMEX and NASDAQ from 1962 – 1989. The stocks were sorted by size (measured by the market value of equity) for all the three markets and ten size based portfolios were constructed. The model was tested using *Fama – MacBeth Regression* approach and the results supported the notion that size helps in explaining the cross section of returns where as beta alone is not sufficient to explain the variations. Similar results were obtained for book to market (value premium). FF noted that although book to market ratio has a stronger impact than size but it cannot replace the size in explaining average returns and when both were combined in the model, it yielded even better results. They concluded that if the asset pricing is rational than the additional risk factors of size and book to market ratio seem to describe average returns, and the probability that such results were due to chance were remote. They added that economic fundamentals suggested that high book to market ratio firms earn lower vis-à-vis low book to market firms. Moreover, during the sample period small firms had a bad patch for earnings as compared to bigger firms. Thus there is a probability that these variables are considered by the investors while pricing an asset. As a concluding note they admitted that if the stock prices are irrational then there is a lower chance that these results will persist.

Fama and French (1993) extended the Fama and French (1992) research by applying a time series regression approach. The analysis was extended to both stocks and bonds. The monthly average returns on stocks and bonds were regressed on five other factors. These factors were excess returns on market portfolio, portfolios sorted by size, portfolios sorted by book to market, term premium and default premium. They found that the first three factors were significant for stocks while the last two were significant in explaining returns on bonds. They confirmed the existence of size and value premium in US returns and commented that a three factor model better explained the risk return puzzle.

Fama and French (1995) tried to provide economic rationale for their three factors model by relating return factors to earning shocks. They studied the characteristics of value as well as growth firms. Their analysis reported that firms with high book to market ratio have a tendency to be consistently distressed, while firms with low book to market have sustained profitability. This leads to a conclusion that returns for high book to market stocks are a compensation for holding less profitable and riskier stocks. The results demonstrated that sensitivities of HML and SMB are a proxy for relative distress. The firms having low earnings had high book to market and positive slopes for HML, while firms with high earnings had low book to market and negative HML slope.

Claessens et al. (1995) examined the cross section of asset returns in emerging markets. They used data from International Finance Corporation (IFC) for 18 developing countries from 1986 – 1993, and besides beta analyzed additional risk factors and their impact on asset returns. They concluded that in addition to beta, two factors size and

trading volume have the highest explanatory power in most of the countries. Dividend yield and earning to price ratio were also significant but in slightly fewer countries. Lastly, they proposed that exchange rate risk is an important determinant of asset returns.

Daniel and Titman (1997), using a factor analysis approach, analyzed the impact of loadings on stock returns from 1973 – 1993. They investigated that whether the portfolios that share similar characteristics but have different loads exhibit different returns? After controlling for size and book to market, they found that expected returns are not a function of loadings on the Fama and French Risk factors. They posit that it is the covariance between high book to market ratio stocks that posts similar properties rather than sharing of a common risk factor.

Halliwel et al. (1999) replicated Fama and French (1993) study on Australian data. Their results suggested some premium to small size and high book to market ratio stocks. Despite observing some premium on SMB and HML factors, there were some inconsistencies with respect to FF three factors model. Firstly, the explanatory power of the three factor model was not as strong as is observed in case of US markets. Fama and French (1993) reported that there is a tendency for the size sensitivity to fall when moving from lower to higher book to market portfolios. This was not evident in Halliwel et al. (1999). Moreover, in Fama and French (1993) a significant improvement was reported in adjusted R^2, when they moved from a single factor to three factor model where as for Halliwel et al. (1999), there was only a marginal improvement.

Davis et al. (2000) extensively studied the characteristics, covariances and average returns from 1929 to 1997. They decomposed the sample into two periods. The first observation was from July 1929 to June 1963 while the second was from July 1963 to June 1997. The value premium, measured by the *HML*, factor for the first half was 0.5 percent per month and was statistically significant (t = 2.80).This was similar to the value premium observed by other authors for the second period valuing 0.43 percent per month with a higher significance (t = 3.38). However, the observed size premium was lower than the value premium. Represented by *SMB* factor, the size premium was 0.20 percent for the whole sample period. They concluded that the value premium in average stock returns is robust. They extended the study of Daniel and Titman (1997) by using a bigger time period of 1929 – 1997. Their results were in contradiction with Daniel and Titman (1997) and they found a relationship between returns and factor loading. They suggested that Daniel and Titman (1997) results were subject to low power of tests and comparatively shorter time span.

Aleati et al. (2000) investigated the relationship between risk factors and returns for Italian stocks. They used factor analyses and time series regressions to identify the economic variables in Italian stock markets. They used the stocks listed on Italian Stock Exchange from 1981 – 1993. Unlike most of the researches, they used individual stock returns in place of portfolio returns due to lesser number of listed firms in Italy. They found out that changes in market index, changes in oil prices, default premium, changes in interest rates and SMB and HML represented viable factors for asset returns in Italian

setting and the SMB and HML factors are priced in the market even if other macroeconomic variables are added.

Connor and Senghal (2001) compared FF three factors model with CAPM to figure out which model better explained the cross section of portfolio returns in Indian stock market. The sample companies for their study were from CRISIL 500 which is similar to the S&P index in US. The companies were sorted on book to market ratio taking above median stocks as *High* while below median stocks as *Low*. Similar sorting was applied for market capitalization with upper 30% as *Big*, Middle 40% as *Medium* and Lower 30% as *Small*. Further, six portfolios were formed on the intersection of size and book to market sorting. They analyzed the comparative level of intercepts by applying the adjusted Wald Statistic. In CAPM three out of six portfolios, the intercept were significant, while for FF three factor model, intercepts for all six portfolios were insignificant. The authors, based on the evidence provided by the intercepts of time series regression for FF three factor model and CAPM, concluded that FF three factor model is a better fit for Indian stock market.

Drew and Veeraraghavan (2002) studied the existence of size and value premium in emerging markets. They used data for Malaysian market from December 1991 to December 1999 and formed six portfolios at the intersection of two size and three book to market portfolios. Their findings proposed the existence of size and value premium which was not documented by the CAPM. They observed that the SMB and HML portfolios generate average returns of 17.7% and 17.6% with a standard deviation of 5.3% and 6.1% respectively while the market or index returns for the period was

substantially lower at 1.92% demonstrating a much higher risk premium for the size and value factors. They rejected the possibility that these results could be due to survivorship bias or data snooping. Further, they rejected the possibility of seasonality in returns and commented that the explanatory variables were strong enough throughout the period to reject the presence of the turn of the year effect. Thus the evidence supports the notions of value and size premium in international markets.

Beltratti and Di Tria (2002) assessed the relevance of multifactor asset pricing models for Italian stocks from 1991 to 2000. The purpose of their research was to analyze the extent to which financial variables can be used as proxies for macroeconomic risk and their relation with the business risk. They compared four asset pricing models including simple CAPM, FF three factors model, a multifactor model including sectors and a multifactor model including change in short term interest rates. Furthermore, they also studied the impact of the design of the sample for the construction of HML and SMB factors. The results demonstrated that the FF three factors model, among others, best explains the cross section of returns in Italian markets. The explanatory power of the model is dependent on the approach of the tests. The time series estimates resulted in constants that were significant while for cross section regressions none of the coefficient was significant where as the theory suggests that the average risk premiums should be significantly positive. They attributed these discrepancies to the instability in Italian markets that has generated unexpected returns for the investors; and commented that time series is the best approach to be used for Italian case; and time series analysis reveals FF three factors model to be most appropriate. However, they pointed out some issues

regarding FF three factors model. The result could not establish a robust relationship between SMB, HML and some important macroeconomic variables. They proposed the existence of some other *local* factors that could have better explained the variability in returns. Lastly, they raised the issue of strong non normality in returns of the factor portfolios.

Drew and Veeraraghavan (2003) studied the explanatory power of a single index model with that of FF three factor model. The countries examined were Hong Kong, Korea, Malaysia and Philippines. They concluded that the size and value premia were present in these markets and the three factor model better explained the variations in returns for these markets. They commented that these premia are the compensation for risk that is not accounted for by CAPM.

III. Research Methodology

As mentioned earlier, emerging markets have their dynamics that are different from developed markets. KSE was declared as open market in 1991 though the pace of market activity has been stagnant till 2002. Starting from 2003, Pakistani markets have seen a new bull rally that has continued till present (March 2008) with some corrections and few panics. However, in general the investor sentiment is positive and it is believed that market hype is backed by strong fundamentals. The pre 2003 era was dominated by low activity, fewer investors and high transaction costs.

Therefore in this study sample period was from January 1, 2003 and extend to five years till December 31, 2007. Another reason that validates this time period selection is the events of September 11, 2001. The post September 11 world has a totally different investment scenario. The attributes and investments behaviors are more cautious and risk averse. Thus, it was likely that if the sample period included both pre and post September 11 data, the difference in investments characteristics could create a potential bias in results; so it seemed prudent to include a lag of one year and begin the data from January 2003.

III.I Model Specification

Fama and French contend for a multifactor asset pricing model and their three factor model is an extension of a single factor CAPM. Besides the traditional beta it

includes two additional factors to account for size and value premia. Mathematically, we can represent the three factor model as

$$R_{it} = R_f + (R_{mt} - R_f)b_{1t} + (SMB)b_{2t} + (HML)b_{3t} \quad \text{with } t = 1, 2, 3, \ldots, T$$

Where R_{it} represents expected return on stock *i*, $R_{mt} - R_f$ represents market premium, *SMB* is the size premium and *HML* represents value premium. The coefficients are the risk sensitivities of returns for market risk (β_{1t}) followed by size (β_{2t}) and value (β_{3t}).

In order to test FF three factor model, we follow the traditional multivariate regression framework and transform the above equation into a simple time series model represented as follows

$$ER_{it} = a_i + RP_t b_{1t} + (SMB)b_{2t} + (HML)b_{3t} + e_t$$

Where $ER_{it} = R_{it} - R_f$ is the excess return on stock *i*, $RP_t = R_{mt} - R_f$ is the risk premium, a_i is the intercept of regression equation representing non market return component, while e_t represents the random return component due to unexpected events related to a particular stock. It is assumed that e_t has a multivariate normal distribution and is independently and identically distributed over time. It was hoped that if the model holds then a_i would be non significant.

The above mentioned model represents the three factor model for an individual stock. By replacing security *i* with a portfolio of stocks P, the three factor model can be expressed as follows

$$ER_{Pt} = a_P + RP_t b_{1t} + (SMB) b_{2t} + (HML) b_{3t} + e_t$$

where $ER_{Pt} = R_{Pt} - R_f$ and $R_{Pt} = \sum_{i=1}^{N} w_i R_{it}$ with w representing the weight of stock in portfolio.

Therefore, the excess portfolio return can be reflected as $ER_{Pt} = \sum_{i=1}^{N} w_i R_{it} - R_f$, the non market return component will be $a_P = \sum_{i=1}^{N} w_i a_i$ which is the average of the individual alphas.

III.II Dependent and Independent Variables

III.II.I Dependent Variable

The dependent variable for FF three factor model is the excess portfolio return represented by $ER_{Pt.}$ The excess return reflects the return over and above risk free rate required by the investor to justify risk taking. As already mentioned, portfolio return is the weighted average of all stocks included in a portfolio.

III.II.II Independent Variables

` The dependent variables include *market risk premium, size factor and value factor*. Market risk premium, measured as difference between return on market portfolio and risk free rate, represents excess return that investor could earn if he invests in market portfolio instead of investing in risk free asset. The market risk *premia* and excess return is same in both CAPM and three factor model, however, three factor model has two other

variables. *SMB* or size premium captures the additional return offered by companies of small size companies vis-à-vis big companies. Similarly *HML* or value premium captures additional return offered by companies whose BV to MV ratio is low.s

The theoretical foundations of *SMB* and *HML* factors are intuitively appealing. Small size companies are more sensitive to various risk factors due to their lower diversified nature of business and even less financial flexibility as compared to relatively bigger firms. Therefore, investors should require a risk premium while investing in small capitalization firms. The *HML* factor attaches a high risk for value stocks than growth stocks. A high book to market ratio depicts a deviation in the book value of firm from its market value indicating that the market is not placing high value to the stocks. This could be due to current distress or investors' expectations about the future prospects making such companies vulnerable to business risk as well as financial risk; making it logical for the investors to demand premium on such stocks.

III.III Sample Selection and Criteria Limitations

As discussed earlier, this study tested the performance of FF three factor model in KSE for five years from January 1, 2003 to December 2007. The sample consists of companies from all industrial sectors listed on Karachi Stock Exchange. The following are the list of criterion that was employed to select stocks from these individual sectors.

1. All selected stocks must be public limited companies listed on Karachi Stock Exchange.

2. For selected companies, daily price data, book value and market value of equity, and market capitalization should be available.

3. The selected stocks must have survived the five year period.

4. In order to avoid thinly traded stocks, only those stocks were included which have been traded for at least 90% of the trading days during the sample period.

5. Fama and French did not include financial sector firms in their study. However, due to very active participation of banking stocks in KSE we have not excluded financial sector.

6. Once the sample was selected, it was be sorted on the basis of market capitalization and was compared across sectors. In order to eliminate extremely small firms and create some homogeneity with respect to size, lower 5% was excluded. Based on this criterion 81 companies were selected. Table 1 summarizes the participation of each industrial sector in the selected sample.

Table 1
Number of Selected Companies for Each Sector

No	Sector	No of Companies	% in Sample
1	Auto Assembler	4	4.94%
2	Automobile Parts	1	1.23%
3	Banks	10	12.35%
4	Cable & Electrical	1	1.23%
5	Cement	5	6.17%
6	Chemicals	2	2.47%
7	Engineering	2	2.47%
8	Fertilizers	3	3.70%
9	Food and Personal Care	5	6.17%
10	Glass and Ceramics	4	4.94%
11	Insurance	5	6.17%
12	Jute	1	1.23%
13	Leasing	3	3.70%
14	Leather	2	2.47%
15	Oil and Gas Exploration	2	2.47%
16	Oil and Gas Marketing	4	4.94%
17	Paper & Board	2	2.47%
18	Pharmaceutical	3	3.70%
19	Power	5	6.17%
20	Refinery	2	2.47%
21	Sugar	3	3.70%
22	Technology	2	2.47%
23	Textile	5	6.17%
24	Tobacco	2	2.47%
25	Transport	2	2.47%
26	Vanaspati	1	1.23%
	TOTAL	**81**	

The financial sector including banks, insurance and leasing stocks constitutes approximately 23% of the total selected sample. The higher proportion of financial firms in the sample is attributed to the activity of these stocks in KSE with stocks like MCB, NBP, Orix Leasing etc among the volume leaders. As mentioned earlier, most of the studies have been conducted by excluding the banking sector due to highly differentiated risk profiles. Another reason for their exclusion in other studies was that in most of the developed markets banking stocks are subject to thin trading and are not dominant vis-à-vis other sectors. However, the dynamics in emerging markets in general, and Pakistan in

specific, are such that the exclusion of banking and financial sector was not justified. The domination of banking sector was deemed to helpful in analyzing the robustness of the three factor model. Textile sector has a moderate contribution of 6%. Despite being the largest sector the low participation of textile sector in sample is due to the fact that most of the textile scrips are subject to thin trading with a few stocks having zero trade for the sample period. Other dominating sectors in the sample are Auto Assemblers and Power with some highly liquid stocks.

III.IV Types and Sources of Data

The secondary data from KSE is used for this study. As reported by Davis (1994) frequency of returns estimate do not improve or deteriorate results, the daily returns were used to increase the number of observations. In order to estimate daily returns daily closing stock prices were used. The observation of true market portfolio within the framework of various asset pricing models is not possible and for empirical studies *synthetic market portfolios* are used. It was desired to mimic the market portfolio by using KSE 100 index.

A risk free asset is one which yield a certain return. In practice, no such assets exist and investors use government issued securities as risk free assets and their returns as risk free rate. However, even if these securities are default risk free yet they are not virtually risk free and at minimum they have inflation risk. For this analysis, six months Pakistan's T Bill yield as a risk free proxy was used.

III.IV Estimation of Variables

III.IV.I Daily Portfolio and Market Returns

The portfolio returns are weighted average returns of individual stocks. The returns for the portfolio was estimated as follows

$R_{Pt} = \sum_{i=1}^{N} w_i R_{it}$, and $R_{it} = LN\left[\frac{P_t}{P_{t-1}}\right]$, where P_t and P_{t-1} are closing prices on day t and t-1. These individual returns are then weighted according to their contribution in the portfolio to obtain portfolio returns.

Similarly the return on market portfolio represented by return on KSE-100 index $R_{mt} = LN\left[\frac{KSE(100)_t}{KSE(100)_{t-1}}\right]$, with $KSE(100)_t$ and $KSE(100)_{t-1}$ as the closing index values on day t and t-1. The portfolio and market returns were then used to estimate excess portfolio returns ($R_p - R_f$) and market risk premium ($R_m - R_f$).

III.IV.I Size and Book to Market Portfolios

The selected sample stocks were ranked on market capitalization (price times number of shares) to denominate size from 2003 to 2007 taking December 31 of each year as the reference point. The median of the sample was used to split the stocks into two categories namely *Big* (B) and *Small* (S). Table 2 represents the biggest, median and smallest capitalization stocks in the sample.

Table 2

Size Sorted Portfolios (2003 – 2007)

No	Size	Capitalization (Million of PKR)
1	Maximum(B)	180,308
2	Median	4,682
3	Minimum (S)	31

Book to Market (BM) ratio was calculated by dividing book value of equity to market value of equity on December 31 for each year of the sample. The stocks were then ranked and categorized into three BM groups based on the break points of bottom 30% classified as Low (L), middle 40% classified as Medium (M) and top 30% classified as High (H). Six portfolios were formed on the intersection of two size and three book to market portfolios. These six portfolios were B/L, B/M, B/H, S/L, S/M and S/H. B/L portfolio contained stocks that were in big group and have low BM ratio where as S/H portfolio contained stocks that were in small size group and high book to market ratio.

Fama and French (1996) and Lakonishok, Shliefer and Vishny (1994) contended for equally weighted portfolios and suggested that three factor model performed even better in equally weighted portfolios than in value weighted portfolios. Therefore, for this study equally weighted portfolios were built to compute portfolio returns. Table 3 represents sector wide participation in these six portfolios.

Table 3

Sector wise Size and Book to Market Portfolios

No	Sector	S/H	S/M	S/L	B/H	B/M	B/L	Total
1	Auto Assembler	1	0	1	0	0	2	**4**
2	Automobile Parts	0	1	0	0	0	0	**1**
3	Banks	1	0	0	1	6	2	**10**
4	Cable & Electrical	0	1	0	0	0	0	**1**
5	Cement	1	0	0	2	2	0	**5**
6	Chemicals	0	0	0	1	0	1	**2**
7	Engineering	0	1	0	0	0	1	**2**
8	Fertilizers	0	0	0	0	0	3	**3**
9	Food and Personal Care	2	1	1	0	0	1	**5**
10	Glass and Ceramics	2	2	0	0	0	0	**4**
11	Insurance	0	3	0	0	0	2	**5**
12	Jute	0	0	1	0	0	0	**1**
13	Leasing	1	2	0	0	0	0	**3**
14	Leather	0	1	1	0	0	0	**2**
15	Oil and Gas Exploration	0	0	1	0	0	1	**2**
16	Oil and Gas Marketing	0	0	0	0	2	2	**4**
17	Paper & Board	0	1	0	0	0	1	**2**
18	Pharmaceutical	0	2	0	0	0	1	**3**
19	Power	3	0	0	1	1	0	**5**
20	Refinery	0	0	0	0	0	2	**2**
21	Sugar	2	1	0	0	0	0	**3**
22	Technology	1	0	0	0	1	0	**2**
23	Textile	2	2	0	0	1	0	**5**
24	Tobacco	0	0	0	0	1	1	**2**
25	Transport	0	0	0	1	1	0	**2**
26	Vanaspati	1	0	0	0	0	0	**1**
	Total	**17**	**18**	**5**	**6**	**15**	**20**	**81**

III.IV.II Market Premium SMB and HML Factors

Market premium was estimated as the difference between return on KSE100 index and the 6 month T bill yield. As mentioned before, this factor is similar to CAPM, however, for three factor model there are two more risk factors namely SMB and HML. Market risk premium was estimated as follow

$$RP_t = R_{mt} - R_f$$

SMB capture the risk premium in returns related to firm size. It is the difference between the average returns of the equal weighted three small markets capitalization portfolio and the three big market capitalization portfolios. Mathematically

$$SMB = \frac{\left[S/L + S/M + S/H\right]}{3} - \frac{\left[B/L + B/M + B/H\right]}{3}$$

HML accounts for the risk premium that is related to firm value. It is the difference between the return on portfolio of high book to market ratio stocks and return on a portfolio of low book to market, constructed to be neutral vis-à-vis size. It can be represented as follows

$$HML = \frac{\left[S/H + B/H\right]}{2} - \frac{\left[S/L + B/L\right]}{2}$$

Given that the data frequency was daily; all our estimates were on intraday basis.

III. V Hypotheses

The regression model was applied for testing the validity of FF three factor model. This model was tested for the six size and book to market portfolios. The excess returns on each portfolio were regressed on three factors namely market risk premium, size premium and value premium. The model is

$$ER_{it} = a_i + RP_t b_{1t} + (SMB) b_{2t} + (HML) b_{3t} + e_t$$

Since this is a multivariate regression model, the following hypotheses (alternative) will be tested.

$$H_1 : a_P \neq 0$$
$$H_2 : b_{1t} \neq 0$$
$$H_3 : b_{2t} \neq 0$$
$$H_4 : b_{3t} \neq 0$$

Where a_P represents regression intercept and b_{1t}, b_{2t} and b_{3t} represent risk sensitivities of portfolio returns. The three factor model will hold if the intercept is not significant (statistically zero) and the three slope coefficients are significant (statistically different from zero).

IV. Empirical Results and Analysis

IV.I Descriptive Statistics

The daily returns between January 2003 and December 2007 were computed on six sorted portfolios. Table 4 represents the descriptive statistics of these portfolios.

Table 4
Descriptive Statistics of Daily Returns (2003 - 2007)

	S/M	S/L	S/H	B/M	B/L	B/H
Mean	0.07%	0.001%	-0.01%	-0.03%	0.04%	-0.06%
Median	0.15%	0.06%	-0.07%	-0.04%	0.12%	-0.10%
Maximum	4.93%	8.77%	4.80%	10.08%	4.48%	5.30%
Minimum	-6.06%	-10.80%	-5.37%	-7.02%	-5.42%	-5.57%
Std. Dev.	1.20%	2.04%	1.24%	1.55%	1.21%	1.43%

For the sample period, S/M portfolio offered the highest average daily return of 0.07% followed by B/L (0.04%). The maximum per day return was yielded by big stocks having average book to market (10.08%) and the minimum daily return in the observation period was offered by small stocks with low book to market ratio.

The daily standard deviations were on a higher side with 2.04% for S/L stocks being the maximum and 1.20% for S/M portfolio at the minimum. The higher standard deviations for all these portfolios demonstrate a high risk profile for the sample stocks in specific and the Pakistani market in general.

Table 5 document similar characteristics for KSE 100 index returns.

Table 5
Descriptive Statistics of KSE 100 Daily Returns (2003 - 2007)

	Mean	Median	Maximum	Minimum	Std. Dev.
KSE100	0.133%	0.244%	5.797%	-6.042%	1.515%

The mean average daily returns on index portfolio are 0.133% with a maximum of 5.7% and a minimum of - 6.04% with a standard deviation of 1.51%.

From 2003 to 2007 the average daily market risk premium was dominant as compared to size and value premia. Interesting thing to note was the magnitude of average value premium which was negative. This was due to negative mean returns on S/H and B/H portfolios. Given negative mean returns for HML factor, it can be concluded that on average growth stocks outperformed value stocks in terms of returns. However, the size premium was positive with small stocks generating higher average returns and thus small caps outperformed large caps. Table 6 summarizes the results for the three factors.

Table 6
Factors Statistics (2003 – 2007)

	RP	SMB	HML
Mean	0.114%	0.012%	-0.065%
Median	0.224%	0.002%	-0.122%
Maximum	5.782%	3.075%	4.906%
Minimum	-6.065%	-3.919%	-4.540%
Std. Dev.	1.516%	0.862%	1.336%

Table 7 shows the correlations between the returns on portfolios. The maximum correlation of 32% was found between small stocks with medium and low book to market ratio. B/H and S/M portfolios also depicted a similar level of correlation of returns.

Table 7
Correlations Between Sorted Portfolio Returns

	S/M	S/L	S/H	B/M	B/L
S/L	32.22%				
S/H	8.42%	13.19%			
B/M	24.21%	-37.24%	17.70%		
B/L	-29.73%	-12.24%	-74.16%	-9.23%	
B/H	32.07%	16.57%	29.72%	-4.54%	-31.38%

IV.II Regression Results

The analysis was based on multivariate regression analysis. The dependent variables was the excess returns on six size and book to market portfolios; while independent variables were the three risk premia (RP), size premium (SMB) and value premium (HML). Table 8 provides the correlation matrix of independent variables i.e. three risk premia.

Table 8
Correlations between Independent Variables (2003 – 2007)

	RP	HML
HML	0.76%	
SMB	-5.58%	-49.64%

The observed correlations between the three independent variables were negligible between market premium and value premium (0.76%); and between market risk premium and size premium (-5.5%). On the contrary, the coefficient was high for size risk premium and value risk premium, though in opposite direction.

With a low correlation between market risk premium and size risk premium and value risk premium, it was clear that SMB provided a valid rationale for size premium that is relatively free of market risk premium. Similarly, HML could be regarded as a measure of value premium that was not dependent on market risk premium. The following three factor regression was used for the sample

$$ER_{Pt} = a_P + RP_t b_{1t} + (SMB) b_{2t} + (HML) b_{3t} + e_t$$

Table 9 summarizes the results of FF three factor model. The tests of the three factor assumes that intercept should not be significantly different from zero and slope coefficient should be significant. This study has mixed results on the validity of three factor model. The estimated coefficients were encouraging for the existence of size and value premia in KSE, but they negate the presence of market risk premium. In six size to value portfolios, the results were significant for four portfolios (B/H, B/M, B/L, S/H) while in S/M and S/L portfolios null hypotheses could not be rejected for the intercept.

Table 9
Three Factor Regression on Portfolios Sorted for Size and Book to Market

	α	β_1	β_2	β_3	$t(\alpha)$	$t(\beta_1)$	$t(\beta_2)$	$t(\beta_3)$	R^2
B/H	-0.0001	-0.012	-0.013	0.692	-0.475	-0.593	-0.312	25.821*	0.424
B/M	0.0001	-0.003	-1.057	0.352	0.205	-0.158	-28.806*	14.869*	0.617
B/L	-0.0001	-0.015	-1.070	-0.957	-0.792	-1.972*	-69.324*	-96.197*	0.890
S/H	0.0003	0.024	0.371	0.674	0.929	1.321	10.117*	28.573*	0.408
S/M	0.0009	0.046	0.137	0.444	2.928*	2.258*	3.352*	16.865*	0.210
S/L	0.0010	-0.921	0.334	0.006	2.465*	-33.661*	6.019*	0.167	0.498

*** Significant at 95%**

The existence of market risk premium along with size and value premia was supported in B/L portfolio with R^2 of 0.89. The value premium is significant for all portfolios and dominated other two factors, however, the size effect was not there in B/H portfolio. The signs of coefficients for the four portfolios were consistent with the FF proposition. The SMB coefficient was positive for small portfolio (S/H) and negative for big size firms (B/M[2] and B/L) confirming the size premium. Similarly, HML factor 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 was adequate with high R^2. In order to test the robustness of the model and control for size effect, 1/5 of the sample firms around the median (17 in total) were eliminated. The remaining firms were sorted on size and book to market ratio and resulting factors were regressed on excess returns. The regression results for reduced sample are reported in Table 10. These results confirm the existence of size and value premium in Karachi Stock Exchange for B/H, B/M, B/L and S/H portfolios. Moreover, the insignificant coefficients, for S/L portfolio in full sample became significant in reduced sample on controlling for size effect.

Given these regression results it can be deduced that majority of results favor of FF three factor model – atleast in case of Karachi Stock Exchange. There are plausible explanations for these results. In emerging markets investors are more concerned about the trading volumes and size of the firm. Since, panics are common in such markets, investment decisions are driven by big liquid stocks.

[2] The model was also tested by excluding the banking stocks for B/M portfolio as it was likely that higher proportion of banks in portfolio could have contributed towards significant results. In the absence of banking stocks the results remained robust with significant market risk premium with α (0.001), β_1 (0.05)*, β_2 (-0.88)*, β_3 (0.36)* and (R^2 of 0.43).

Table 10

Three Factor Regression on Portfolios with Reduced Sample Sorted for Size and Book to Market

	α	β_1	β_2	β_3	$t(\alpha)$	$t(\beta_1)$	$t(\beta_2)$	$t(\beta_3)$	R^2
B/H	0.0007	0.0836*	-0.6744*	0.8308*	1.4633	2.6832	-12.9119	23.5228	0.6062
B/M	0.0011	0.0911*	-0.5953*	0.0932*	0.9788	3.7042	-14.4442	3.3431	0.2872
B/L	0.0011	0.0675*	-0.5233*	0.0188*	0.7790	3.1645	-14.6280	3.5039	0.2468
S/H	0.0012	0.0892*	0.6090*	0.9329*	1.0802	3.5352	14.3986	32.6181	0.4829
S/M	0.0010*	0.0477*	0.1400*	0.2651*	3.3848	2.3989	4.1982	11.7544	0.1162
S/L	0.0007	0.1053*	0.4579*	-0.2552*	1.4520	3.1493	8.1720	-6.7351	0.2071

*** Significant at 95%**

In this study, portfolios supporting the existence of size and value premium were constituted of stocks that were considered best pick for the local investors based on the market activity and size of these companies. An important point should be dealt with care. The sample period was overall a bull rally in Pakistan, therefore results only confirm the presence of size and value premium in a bullish market.

Nevertheless, an alternate explanation is possible for the portfolios with significant intercepts and it leads to further research. Daniel and Titman (1997) contended for a characteristics model which allows that non zero intercepts were expected when stocks have value premium loadings that are not balanced with their book to market ratio. Therefore, it is likely that the value loadings for S/M and S/L portfolios are not in proportion vis-à-vis their size and book to market ratios.

V. Conclusion

Asset pricing or alternatively expected rate of return is a puzzle that financial economists have been trying to solve for almost half a century. There have been some propositions that gained attention while there were many more that were laid to rest without being noticed. The single and multi factor asset pricing models have mixed results in different parts of the Globe. Some researchers advocate for the single factor beta as the most viable risk factor determining returns; others report that beta has long been dead. This paper tried to explore the power of FF three factor model in an emerging market.

The stocks were selected from Karachi Stock Exchange and sorted into six portfolios at the intersection of size and book to market ratio. Sample period constituted daily stock returns between 2003 and 2007, and KSE100 index was used as the benchmark for market returns with 6 month T bill rate as the risk free proxy. A multivariate framework was deployed to test for the validity of three factors model. The results showed that except for two portfolios (S/M and S/L) the intercept terms were insignificant and thus FF three factor model seemed explain returns for Karachi Stock Exchange. However, the market risk premium factor was relevant in explaining returns only in one of the six portfolios.

This empirical evidence suggests that FF three factor model is valid for KSE. This observation has important implications for fund managers, investors and corporate managers. Traditionally, fund managers and investors have been using a single factor model for portfolio management and asset valuation. The presence of two additional risk factors warrants their inclusion for investment analysis. The use of size and value premia in addition to market risk premium will result in a different risk return structure as compared to single factor model. Inclusion of additional risk premia might require a portfolio rebalancing by the fund managers. Similarly, investors are likely to be willing to invest in small firms and value stocks to target higher returns. Moreover, with additional factors in place, the estimation of cost of equity might vary that could ultimately change the estimates for project appraisals, financing choices and composition of capital structure.

However, caution should be exercised since this research was conducted in a bull market and it is not clear that size and value premia will be present in bearish market and

is proposed for further research. It is also proposed that on same data set the model should be tested without sorting the portfolios and its robustness should be checked for sub time periods (Jan 2003 – June 2005 and June 2005 – Dec 2007). It is further proposed that various data frequency (weekly, monthly etc) should be used to test the efficacy of the model.

Lastly it must be added that asset pricing models are valuable to deduce economic rationale behind investment decisions but they are burdened with problems when used to analyze the human behavior. Financial economists have encountered problems whenever they have tried to model investor 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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