DOI: 10.20472/EFC.2017.008.015

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CROSS-SECTIONAL VARIATION IN STOCK RETURNS: EVIDENCE FROM AN EMERGING MARKET

Abstract:

Fama and French (1992) reported that the two fundamental factors, size and book-to-market (BM) explains the cross-sectional variation in stock returns and the relationship between beta and average returns is flat. This study reports the market risk as the most significantly priced factor for Pakistan's stocks. Investors in Pakistan's equity market are compensated for the size, BM and momentum factors, but the relationship between risk and return as given by Capital Asset Pricing Model (CAPM) is strong and remains powerful even with the addition of size, BM and momentum factors. The significant role of beta reported for Pakistan's stocks justifies the use of CAPM in stock valuation.

Keywords:

Market Beta, Size, BM Ratio, Momentum, Pakistan Stock Exchange.

JEL Classification: G11, G12, G14

1. INTRODUCTION

The cross-sectional variation in common stock returns, for the developed as well as the emerging markets, is substantial. Moreover, this variation in stock returns has increased steadily over time. As the capital markets across the globe have developed and the investor base has expanded, trading activity in the stock market has increased; thus, leading to larger changes in stock prices. Furthermore, the listed stocks have become more heterogeneous over time, resulting in their price changes which are less correlated, which has also led to the increased variation in stock returns (McEnally & Todd, 1992). With the substantial variation present in the stock returns, selection of stocks based on the desirable risk factors is crucial for the practitioners in finance. Identifying the factors which explain the stock returns is an empirical issue. Studies that attempt to determine the factors driving the stock returns have been very popular in finance academics and these studies have led to the development of various asset pricing models.

This paper re-examines the factors explaining the cross-sectional variation in stock returns and compares the validity of various asset pricing models with data from Pakistan Stock Exchange (PSX). The study is motivated by three facts: First, most of the literature on asset pricing models is based on data from developed markets and the evidence from emerging markets remains limited. Second, findings reported by the two studies conducted on the topic in Pakistan (Mirza & Shahid, 2008 and Haque & Sarwar, 2013) are inconsistent which makes it important to cross-check the results with an extended and more recent sample period. Finally, Pakistan's financial market has become more attractive to the local and foreign investors after the decision by MSCI in June 2016 to upgrade Pakistan Stock Exchange from frontier to emerging markets[1]. With an improved understanding of the factors explaining the stock returns, the investors will be able to make more reliable and informed investment decisions.

2. LITERATURE REVIEW

Fama-French (1992) evaluated the joint explanatory power of market beta, size, earnings-to-price, leverage, and book-to-market equity for the stocks of non-financial firms listed on the NYSE, AMEX and NASDAQ for the period 1963 to 1990. For the study period considered by FF, the relation between beta and average return disappeared after controlling for size, the effect of leverage was captured well by book-

[1] In December 1993, the MSCI Pakistan Index was launched and it remained part of MSCI Emerging Markets Index for 15 years. However, after the stock market crash during 2008, MSCI Pakistan Index was removed from the MSCI Emerging Markets Index and Pakistan was included in the MSCI Frontier Market Index in May 2009 and remained part of this index since then. As per the decision taken in June 2016, Pakistan will be reclassified from Frontier Markets to Emerging Markets effective May, 2017

to-market (BM) ratio, and the effect of earnings-to-price (EP) ratio was captured by the combination of size and BM ratio. Based on these findings, FF concluded that the two variables, size and BM, capture the effect of other variables and fully explain the cross-section of average stock returns. Moreover, FF found these two factors of size and book-to-market equity to be negatively linked with a correlation of -0.26. The three-factor model of FF can be expressed as follows:

$$R_i = \alpha + \beta_1 MKT + \beta_2 SMB + \beta_3 HML + \varepsilon_i$$

Where R_i represents the expected return on portfolio *i*, *MKT* represents the market risk premium which the investors get through investing in high beta stocks, *SMB* represents the size premium which the investors get through investing in small firms and *HML* represents BM premium which the investors get through investing in value firms (firms with high BM ratios).

The three-factor model presented by FF became highly popular among the academicians and practitioners and intense debate emerged in the academic literature regarding the explanatory power of beta and firm's fundamental factors. Since the FF model was developed based on U.S. data, researchers tested for the robustness of the model through performing similar studies using the data from markets other than U.S. or using the out-of-sample data. Most of these studies (Fama & French, 1995; Barber & Lyon, 1997; Fama & French, 1998; Drew & Veeraraghavan, 2002; Drew, Naughton & Veeraraghavan, 2003; Walkshausl & Lobe, 2014) reported the results consistent with the FF three-factor model.

Carhart (1997) constructed a four-factor model using the FF three factors plus an additional factor capturing the one-year momentum effect which was originally documented by Jegadeesh and Titman (1993). He compared the results of CAPM, FF three-factor model and the four-factor model using the data of diversified equity funds in U.S. over the period 1962 to 1993 and found that the four-factor model well-explained the considerable variation in stock returns, reduced the pricing errors which exist in the results of the other two models, and eliminated all of the patterns in pricing errors. Based on these finding, he concluded that the four-factor model is superior over the two previous models.

Unlike the literature on cross-sectional variation in stock returns available on U.S. and other developed markets, the literature available on the topic in developing or emerging markets is recent and limited and it reports mixed findings. Rouwenhorst (1999) attempted to find the sources of return variation in emerging stock markets using a sample of 1705 firms from 20 emerging markets, included in the emerging market database of IFC, and reported that the factors that explain the cross-sectional

differences in expected stock returns in emerging equity markets are qualitatively similar to those documented for developed markets. However, many studies from emerging markets (e.g., Claessens, Dasgupta & Glen, 1995; Chen & Zhang, 1998; Bekeart, Harvey & Lundblad, 2007; Nartea, Gan & Wu, 2008; Firozjaee & Jiloder, 2010; Eraslan, 2013) have presented the results which are inconsistent with the findings from developed markets. These studies have either reported different factors explaining the stock returns in emerging markets or they have reported the same factors with significantly different impacts for the emerging market.

Pakistan Stock Exchange (PSX) is the largest stock exchange of Pakistan with the highest number of listed companies, turnover rate and market capitalization. PSX has demonstrated very good performance in the recent years and was amongst the world's best performing markets for the years 2012 and 2013 with an annual increase of 49% for each of these years. In June 2016, the decision was taken to upgrade Pakistan's equity market from frontier to emerging market group by MSCI. With this decision of reclassification, Pakistan's equity market has become more attractive for local and foreign investors. These investors would be interested in understanding how the various risk factors are priced in the market. However, the literature available on the factors affecting stock returns in Pakistan is quite limited. The studies conducted to identify the determinants of equity returns in Pakistan include Mirza and Shahid (2008) and Haque and Sarwar (2013) and these studies have presented contradictory results. Mirza and Shahid (2008) used the data over the period from 2003 to 2007. Their study confirmed the existence of the size and value premiums for stocks listed on PSX and, hence, concluded that FF model performs adequately for Pakistan's stocks. However, the study by Haque and Sarwar (2013), which used the data over the period 1998 to 2009, documented that the equity returns in Pakistan are well-explained by the CAPM model and not by the Fama-French model. Contradicting with FF results, this study found an insignificant size effect and a significant but negative book-to-market effect. The negative BM effect was attributed to the overvaluation of stocks listed on PSE.

Given the limited scope of work available on the explanation of stock returns in Pakistan and the contradictory findings reported by these works, there is a need to re-examine the topic with an extended and more recent data. This paper aims at contributing to the literature on asset pricing from emerging markets through re-examining the factors explaining the cross-sectional variation in stock returns and through comparing the validity of various asset pricing models with an extended and recent data from Pakistan Stock Exchange (PSX).

3. DATA AND STUDY SAMPLE

The study uses the data for all non-financial firms listed on PSX over the 15-year period from January 2001 to December 2015. The study excludes the firms with missing data, the firms with infrequently traded stocks, and the firms with negative book equity. The infrequently traded firms (firms with zero returns for a continuous 6-month period) are excluded as the shares of such firms cannot be traded in time as per the requirement of investment strategy and hence are not included in the investment universe. The firms with negative book equity are not comparable with normal firms as these firms are likely to be financially distressed and must generate higher returns to compensate for their default risk. The selected sample period is a port-reform period[2] when the financial system of Pakistan including the equity market was strong and diversified and is also justified based on the availability of financial data during this time period. Based on the above criteria, 134 firms are selected to be included in the sample. These firms belong to 11 main sectors with the textile sector making up around 38% of the sample. This sector's contribution is highest as it is the largest sector in Pakistan's economy with 164 firms out of a total of 529 listed companies (Government of Pakistan, 2014).

For all the stocks selected in the sample, the study uses the month-end stock price data over the sample period, market capitalization on June-end and December-end for each year in sample period and the fiscal year-end book value of assets for each year in sample period. The total return prices of the sample stocks are taken from Bloomberg database. The data on stocks' market capitalization and firms' book values are taken from State Bank of Pakistan and Pakistan Stock Exchange.

KSE-100 index is used as a proxy for market portfolio. The index was launched in 1991 and comprises of 100 companies listed on PSX selected on the basis of sector representation and free-float capitalization of the companies. Six-month Treasury bill rate is used as the proxy for risk-free return. Treasury bills are zero-coupon debt certificates issued by the Government of Pakistan and are backed by the full credit of the Government. The data on KSE-100 indices is taken from Pakistan Stock Exchange and the monthly time series of the 6-month Treasury bill rates is taken from State Bank of Pakistan.

4. METHODOLOGY

Ordinary least square regressions are used to compare the single factor, three-factor and four-factor models. The following regressions are estimated for the portfolios sorted on basis of size, BM and 1-year momentum factors:

[2] The financial system of Pakistan underwent a series of deregulation and liberalization policies in early 1990's. These reforms included permitting the foreign investors to buy the shares of listed firms, establishment of an efficient public debt system and an efficient monetary policy with less government interference.

$$ER_{p_i,t} = \alpha_{p_i t} + \beta_{p_i t}\left(R_{m,t} - R_{f,t}\right) + \varepsilon_{p_i t}$$

$$ER_{p_i,t} = \alpha_{p_i t} + \beta_{p_i t}\left(R_{m,t} - R_{f,t}\right) + \pi_{p_i t} SMB_t + \Omega_{p_i t} HML_t + \varepsilon_{p_i t}$$

$$ER_{p_i,t} = \alpha_{p_i t} + \beta_{p_i t}\left(R_{m,t} - R_{f,t}\right) + \pi_{p_i t} SMB_t + \Omega_{p_i t} HML_t + \mu_{p_i t} WML_t + \varepsilon_{p_i t}$$

Where $ER_{p_i,t}$ is the excess return of portfolio *i* for month *t* , $R_{m,t}$ is the market return for month *t*, $R_{f,t}$is the risk-free rate for month *t*, and SMB_t, HML_t and WML_T are the size, BM and momentum factor returns respectively.

The factor returns of size, book-to-market and momentum are calculated using two different approaches. The first approach involves creating the factor returns on basis of single risk dimension. While computing the factor return based on the single risk dimension, the stocks are sorted into five portfolios based on the single risk factor. The difference in the average monthly returns for the two extreme portfolios (one with highest risk factor and other with lowest risk factor) is taken. Due to the small number of stocks in sample, the study allocates 20% of stocks to each portfolio to calculate these arbitrage returns. This gives an average number of stocks per portfolio of 27 which is sufficient to ensure the risk diversification. However, in literature the arbitrage returns are mostly computed based on deciles, which means the high-risk portfolio in literature has more risk concentration than the high-risk portfolio in this study. To make the portfolio construction consistent with the literature, we also perform the analysis using the 15-stock portfolio which implies an allocation of around 11% to the highest and lowest risk portfolios. The second approach for computing the factor returns sorts the stocks sequentially. The stocks are first sorted on basis of their size in two portfolios, small and large. Each of these portfolios are then sorted based on their book-to-market (high or low) resulting in a total of 4 portfolios, Each of these four portfolios are then sorted into two portfolios based on their momentum (winner or loser). Thus, a total of eight portfolios are created. The description of these portfolios is given in Table I. To calculate the factor return, the difference between the average return of the four portfolios high in that risk factor and the average return of the four portfolios low in that risk factor is taken.

Table I

Sequentially Sorted Portfolios

Portfolio Number	Portfolio Name	Portfolio Description
1	SHW	Small stocks with high BM and high prior returns
2	SHL	Small stocks with high BM and low prior returns
3	SLW	Small stocks with low BM and high prior returns
4	SLL	Small stocks with low BM and low prior returns
5	BHW	Big stocks with high BM and high prior returns
6	BHL	Big stocks with high BM and low prior returns
7	BLW	Big stocks with low BM and high prior returns
8	BLL	Big stocks with low BM and low prior returns

4. EMPIRICAL RESULTS AND ANALYSIS

Descriptive Statistics

Sector-wise monthly returns, market capitalization, book-to-market and beta coefficients for the sample firms are presented in Table II. The average 6-month Treasury bill rate (annualized) over the sample period is 8.82% which converts to an average per month rate of 0.75% and the market earned an average premium of 1.10% per month over the study period. Firms in the service sector, on average, earned the highest mean monthly return (7.96%) over the sample period, whereas the fuel and energy sector which comprises of bigger firms compared to other sectors, earned the lowest return (2.54%). All the sectors, however, earned a mean monthly return more than the mean monthly market return. The chemicals and the textile sectors had the most variable returns over the study period. Though the standard deviation of monthly returns for all sectors is more than that of the market but none of the sector has a beta coefficient more than 1. This indicates that the riskier firms are either short-lived or have negative book value, due to which they are excluded from the sample and hence the firms in the sample are, on average, are less risky than the market.

One-Dimensional Portfolios

To calculate the arbitrage portfolio returns, we first construct five portfolios using each of the four risk factors (market beta, size, BM and momentum), resulting in a total of 20 portfolios. Excess returns, market beta, market capitalization (in millions) and book-to-market (BM) ratio for each of these 20 portfolios over the sample period are reported in Table III. These descriptive statistics of the single risk-based portfolios reveal some very important and interesting relationships. The portfolio with highest beta also has the largest average size and the average firm size decreases as we move towards the lowest beta portfolio. This shows the positive relationship between the size and the beta factors for Pakistan's stocks. The positive link between beta and size which is a unique observation for Pakistani stocks can be justified by the fact that in case of Pakistani market, the big stocks are the most illiquid ones (with very low daily turnover), as their prices are very high and hence an average investor cannot afford trading in it. However, the stock prices of such big companies change in big jumps, thus resulting in their high beta coefficients. For the portfolio comprising of smallest size stocks, the average BM

Table II

Mean Monthly Returns, Deviation, Market Capitalization, Book-to-Market and Beta Coefficients over the Study Period

The sample firms are categorized into 11 sectors and the sector-wise descriptive statistics computed over the period from 2001 to 2015 are shown in the table. The return on KSE-100 index (proxy for market) and the 6-month Treasury rate (proxy for risk-free rate) are also shown.

	Monthly Return			Standard Deviation of Monthly Return	Market Capitalization (Million Rupees)				Book-to-Market				Market Beta
	Mean	Lowest	Highest		Mean	Median	Lowest	Highest	Mean	Median	Lowest	Highest	
Textiles	3.51	-96.05	2420.14	10.43	1,600.39	89.78	6.25	137,184.00	3.42	2.07	0.00	60.25	0.42
Chemicals	3.82	-97.50	3821.09	17.16	12,489.15	1,019.22	9.94	190,097.83	0.83	0.63	0.08	3.89	0.74
Sugar	2.96	-100.00	589.94	7.95	852.24	335.65	32.73	18,949.20	2.36	1.59	0.30	17.31	0.36
Other Manufacturing	3.19	-58.49	553.67	9.15	1,915.26	769.84	7.20	28,224.81	1.75	1.15	0.20	11.85	0.59
Automobiles and Parts	3.34	-48.63	83.69	13.57	7,778.60	3,559.66	58.47	98,171.40	0.95	0.67	0.23	4.22	0.74
Food Products	3.12	-44.78	125.03	7.09	19,361.16	1,400.86	35.10	442,203.48	0.58	0.35	0.00	5.81	0.08
Fuel and Energy	2.54	-45.95	187.27	9.62	23,520.28	12,432.77	661.50	135,848.32	0.89	0.70	0.20	2.88	0.98
Cement	2.77	-47.93	148.21	9.39	10,642.74	1,908.77	71.15	168,032.12	1.19	1.04	0.12	5.58	0.85
Service Activities	7.96	-88.45	324.84	29.84	2,058.25	150.82	2.69	16,099.50	2.73	1.69	0.20	14.62	0.93
Paper and Paperboard	3.29	-56.12	251.17	11.22	4,674.78	1,115.17	30.00	52,504.49	2.39	1.41	0.41	19.38	0.46
Electrical Machinery	2.90	-58.33	111.36	10.85	3,006.15	1,037.39	56.19	13,480.25	0.82	0.68	0.18	2.61	0.48
KSE-100 Index	1.85	-36.16	27.27	7.81	-	-	-	-	-	-	-	-	1.00
Six-Month Treasury Bill (Annualized)	8.82	1.21	14.01	-	-	-	-	-	-	-	-	-	-

Table III

Descriptive Statistics for the Portfolios Sorted on Single Risk Factors

Stocks are sorted into 5 portfolios based on each of the 5 risk factors (beta, size, BM and momentum) resulting in a total of 20 portfolios. Excess returns, beta, market capitalization and BM for each of these portfolios are presented in the table.

	Excess Return	Beta	Market Capitalization (in millions PKR)	Book-to-Market
High-*β*	2.3406	1.3496	1466.4871	2.4666
***β*-2**	2.0304	0.7937	1168.2227	2.0285
***β*-3**	2.1756	0.5242	890.4734	1.7889
***β*-4**	3.3941	0.2784	456.8854	2.0767
low-*β*	4.1716	-0.1728	352.3525	2.3518
Small-Size	5.1405	0.4626	60.7220	4.6627
Size-2	2.0229	0.3698	249.3761	2.3219
Size-3	1.8315	0.4945	608.7368	1.5965
Size-4	2.2148	0.5736	2009.6144	1.3572
Large-Size	2.8898	0.8716	13072.1746	0.7670
Low-BM	1.9074	0.5967	4450.6468	0.4044
BM-2	2.7945	0.6242	1399.5312	0.8080

BM-3	2.4416	0.5780	676.6387	1.3660
BM-4	2.3250	0.4781	414.4407	2.1979
Large-BM	4.6536	0.4981	139.1769	5.9205
Low-MMT	2.9093	0.4820	377.4895	2.2554
MMT-2	2.2224	0.5355	749.5626	2.0776
MMT-3	2.3410	0.5768	1175.0245	1.7055
MMT-4	2.9412	0.5976	1141.9179	1.9256
High-MMT	3.7044	0.5833	653.5444	2.7452

is highest and the BM ratio decreases as the average size increases, implying that the smallest firms are the ones with worst future prospects, whereas the large firms have good future prospects. This negative relationship between size and BM is consistent with the findings reported in literature (for example, Fama & French (1992)). The portfolio of stocks with lowest prior period returns comprises of small stocks with the highest BM ratio. The highest excess return is earned by the smallest size portfolio same as reported in many previous studies (for example, Akdeniz et al. (2000) & Kassimatis (2008)).

The year-by-year returns of the three arbitrage portfolios (SMB, HML, WML) are calculated using 27-stock and 15-stock portfolios and presented in Table IVA and IVB respectively. These returns show that size and BM based portfolios have earned positive returns in most of the years. The overall (mean) zero investment return for size factor is 2.36% and for BM factor is 2.09% (with 15-stock portfolios). These positive premiums show that the investors can earn positive arbitrage returns through holding zero investment portfolios based on the size and BM risk factors in Pakistan's equity market. For the momentum factor, positive premiums do not exist for almost half of the years in sample. The overall (mean) zero investment return is positive but low (1.95%). Moreover, this positive momentum factor return has mainly resulted due to the presence of a very high factor return for one year (2002) in the sample period. Thus, the pattern for the zero investment returns for the momentum factor is not consistent and therefore buying the loser stock and selling the winners might also be profitable. These findings are consistent with many studies in the literature. For example, Kassimatis (2008) also reported negative returns for the momentum based portfolio in their study using the data for Australian stocks over the period 1992 to 2005.

Sequentially Sorted Portfolios

We now present the tabular analysis of portfolios sorted sequentially on basis of size, BM and momentum. The sequential sorting ensures that arbitrage returns result due to

one characteristic under study only as we keep the portfolios neutral with respect to other characteristics and hence it is more popular in empirical studies. Table V reports excess returns, market beta, market capitalization (in millions) and book-to-market (BM) ratio for each of the 8

Table IVA

Zero Investment Returns for Portfolios (with 27 stocks) Formed on Single Risk Dimension

At the end of June each year, stocks are sorted in five portfolios on basis of each of the four risk factors (market beta, size, BM and momentum). The first portfolio comprises of 20% of most risky stocks and the last portfolio comprises of the 20% of least risky stocks. Difference between the mean returns of the most and the least risky portfolios are reported in the table.

	Size Premiums	**BM Premiums**	**Momentum Premiums**
2001	-0.0541	0.0602	0.0213
2002	0.1424	0.1551	0.1637
2003	0.0622	0.0239	0.0169
2004	0.0012	0.0054	0.0062
2005	-0.0207	-0.0071	-0.0218
2006	-0.0200	-0.0006	0.0076
2007	0.0001	-0.0147	0.0052
2008	-0.0124	-0.0097	0.0049
2009	0.0407	0.0566	-0.0520
2010	0.0365	0.0349	-0.0185
2011	0.0672	0.0307	-0.0020
2012	0.0608	0.0508	-0.0079
2013	0.0037	0.0121	-0.0007
2014	-0.0038	-0.0132	-0.0116
2015	0.0126	-0.0010	0.0214
Mean	**0.0211**	**0.0256**	**0.0088**

Table IVB

Zero Investment Returns for Portfolios (with 15 stocks) Formed on Single Risk Dimension

At the end of June each year, difference between the mean returns of the high-risk and the low-risk portfolios are taken and reported in the table. The high-risk portfolio comprises of 15 most risky stocks and the low-risk portfolio comprises of 15 least risky stocks.

	Size Premiums	**BM Premiums**	**Momentum Premiums**
2001	0.0563	0.0966	0.0706
2002	0.0061	0.0369	0.2824
2003	0.0215	0.0274	0.0549
2004	0.0114	0.0176	-0.0038
2005	-0.0267	-0.0181	-0.0421
2006	-0.0216	0.0099	-0.0036
2007	0.0206	-0.0307	0.0008
2008	-0.0352	-0.0150	-0.0035
2009	0.0780	0.0535	-0.0577
2010	0.0464	0.0347	-0.0349
2011	0.0904	0.0264	0.0158
2012	0.0622	0.0618	-0.0005
2013	0.0116	0.0035	-0.0138
2014	0.0088	0.0039	-0.0085
2015	0.0243	0.0046	0.0368
Mean	**0.0236**	**0.0209**	**0.0195**

Table V

Descriptive Statistics for the Sequentially Sorted Portfolios

Stocks are sorted into two portfolios, big and small, based on the market capitalization (size). Each of these two portfolios is then sorted into two groups, high and low, based on book-to-market (BM) ratio. Each of these four portfolios is then sorted into two groups, winners and losers. This sequential sorting resulted in a total of eight portfolios. Excess returns, beta, market capitalization, BM and interest rate beta for each of these portfolios are presented in the table.

	Excess Return	Beta	Market Capitalization	Book-to-Market
BLL	1.8321	0.5302	6374.5088	0.4680
BLW	2.0787	0.7036	5771.5248	0.4686
BHL	2.4514	0.7545	2310.4711	1.6955
BHW	3.4620	0.7632	2665.7503	1.8071
SLL	2.2747	0.3874	206.0167	1.3212
SLW	1.7325	0.4895	254.4811	1.1956
SHL	2.9513	0.4499	118.4610	4.5954
SHW	4.4950	0.5067	137.0356	5.4367

sequentially sorted portfolios over the sample period. The portfolio comprising of small stocks with high book-to-market ratio which earned a high return in previous 12-month period earned the highest monthly excess return (4.49%) over the sample period. The market beta of this portfolio is quite low compared to other portfolios, which implies that the excess return which the portfolio has earned is not a compensation of its sensitivity to the market. The portfolios which include stocks of big firms have higher market betas compared to portfolios which include stocks of smaller firms and the book-to-market ratio is higher for portfolios with smaller firms.

The zero investment returns for the three factors, size, BM and momentum, using the sequential sorting are reported in Table VI. The table also gives the mean of the zero investment returns over the sample period. Zero investment returns for all three risk factors are lower when the stocks are sorted sequentially (Table VI) as compared to when the stocks are sorted based on single risk factors (Tables IVA and IVB). This is mainly because for single risk based sorting the risk premiums are calculated using only 20% (in case of 27-stock portfolios) and only 11% (in case of 15-stock portfolios) of the stocks as high and low risk stocks, whereas for sequential sorting half of the stocks are taken as high risk and remaining half as low risk stocks. Thus, the factor returns are positive but very small.

The analysis till now, although simple, has revealed many important clues to explain the variation in stock returns for Pakistani market. We can summarize the preceding observations as:

1. A positive relationship exists between the size and the beta factors for Pakistan’s stocks over the period 2001-2015. This observation is inconsistent and quite surprising in the light of existing literature.

2. Using the tabular analysis only, a reliable relationship with excess returns cannot be seen for any risk factor (beta, size or BM).
3. The arbitrage returns for all three factors are positive, but they are highest for BM sorted portfolios.

In a nutshell, the observed relationship between the average return and size factor is complicated for Pakistan's stocks due to the positive link between beta and size. Large size portfolio is expected to generate low returns but in case of Pakistani stocks, this portfolio is tilted towards the stocks with high beta. Hence, we see a U-shape relationship between excess return and size factor. We now move to the more formal regression analysis to understand the nature of cross-sectional variation in Pakistan's stock returns.

Table VI

Zero Investment Returns for Sequentially Sorted Portfolios

All stocks listed on KSE which met the sample selection criteria are sequentially sorted into 8 portfolios based size, BM and momentum factors at the end of June each year. Zero investment returns are calculated as the difference of the mean return for the four portfolios high on a particular risk factor and the mean return for the four portfolios low on a particular risk factor.

	Size Premiums	**BM Premiums**	**Momentum Premiums**
2001	-0.0297	0.0779	0.0469
2002	0.0583	0.0640	0.0665
2003	0.0301	0.0197	0.0061
2004	-0.0050	-0.0007	0.0003
2005	-0.0017	-0.0107	-0.0160
2006	-0.0161	0.0098	0.0042
2007	-0.0078	-0.0139	0.0014
2008	-0.0036	-0.0076	0.0034
2009	0.0166	0.0355	-0.0151
2010	0.0269	0.0034	-0.0078
2011	-0.0153	-0.0179	-0.0052
2012	0.0250	0.0292	0.0017
2013	-0.0088	0.0157	-0.0011
2014	-0.0136	-0.0029	-0.0092
2015	0.0073	-0.0082	0.0114
Mean	**0.0042**	**0.0129**	**0.0058**

Regression Models for One-Dimensional and Sequentially-Sorted Portfolios

This sections reports the findings of single factor, Fama-French three-factor and Carhart four-factor models and compares the performance of these models in explaining the cross-sectional variation in stock returns for Pakistani stocks.

The monthly excess returns of the single-dimensional portfolios and sequentially-sorted portfolios are first regressed against the monthly excess returns of the market and the results of this single factor model are presented in Table VIIA (for one-dimensional portfolios) and Table VIIB (for sequentially-sorted portfolios). The significant slope coefficients for most of the portfolios (both single dimensionally sorted as well as sequentially sorted) show that the market risk is an important factor explaining the portfolio returns. However, based on the adjusted R-square value, the single-factor model appears to be a poor fit for Pakistani stocks' returns over the sample period. Market beta is able to explain a very small (4.67% in case of single dimension based portfolios and 27.6% for sequentially sorted portfolios) fraction of the total variation in excess portfolio returns. The low value of R-square implies that there are other missing factors which can explain the variation in stock returns.

Table VIIIA and Table VIIIB report the results of the three-factor model when the factor returns are calculated using 27-stock and 15-stock single-dimensional portfolios respectively and Table VIIIC presents the results of three factor model when the stocks are sorted sequentially on basis of size, BM and momentum. A comparison of the results show that the model performs better in explaining the variation for sequentially sorted portfolio returns. The mean adjusted R-square increases drastically (from 27.6% to 53.4%) in moving from the single-factor to three-factor model. In Table VIIIC, all the portfolios containing the small firms have a significant positive size premium which confirms that the investors holding stocks of small firms are rewarded for the size risk in Pakistani equity market. The factor for BM is also significant for all portfolios comprising of firms with high BM. Thus, the high risk of firms with high BM is also rewarded in Pakistani equity market. However, despite the fact that the size and BM factors are significant for many of the portfolios and the explanatory power of the model improves by the addition of the size and BM factors; the market risk still remains to be the most important factor explaining the stock returns. Literature provides evidence of similar findings for other emerging markets, for e.g., Firozjaee and Jiloder (2010) and Eraslan (2013) also reported that even though the three-factor model is better in explaining the variation of expected stock returns for the firms in Iranian and Turkish markets respectively, but the impact of market risk remains significant and stronger compared to the other two risk factors.

Tables IXA and IXB report the results of the four-factor model for the 27-stock and 15-stock one-dimensional portfolios respectively, and Table IXC reports the results of four-

factor model for sequentially-sorted portfolios. As in the case of other two models, the four-factor model performs better for sequentially-sorted portfolios. With the addition of fourth factor (momentum), the adjusted R-square increases to 59.2% and all four factors appear to be significant. However, the market risk remains the most significantly priced factor.

Robustness Tests

Equity market in Pakistan faced a major downward trend in the year 2008 due to which there was very low trading in the market. Since this period of extreme downward trend and low market activity is included in the sample, it might have impacted the results. The single and multiple factor regressions are run again using the data for normal period only (excluding the period of market crash). These results are presented in Tables XA and XB (for single-factor model), Tables XIA, XIB and XIC (for three-factor model) and Tables XIIA, XIIB and XIIC (for four-factor model). The results obtained from the three models after excluding the extreme recessionary period do not depart from the original results.

Table VII

Single Factor Model Regressions on Single Risk Factor Based Portfolios

For the 15 portfolios formed on basis of size, BM and momentum, monthly excess returns are regressed on monthly market excess returns using the regression model: $ER_{p_i,t} = \alpha + (R_{m,t} - R_{p_i,t})\beta + \varepsilon_i$. The slope coefficient for each portfolio, the associated *t*-statistic, *p*-value and the adjusted r-square are reported in the table.

	Coefficient	***t*-value**	***p*-value**	**R-square**
Small-Size	0.8717	2.5262	0.0124	0.0302
Size-2	1.1197	3.4107	0.0008	0.0579
Size-3	0.4246	1.5465	0.1238	0.0080
Size-4	0.5194	1.1211	0.2638	0.0015
Large-Size	0.4821	1.4113	0.1600	0.0057
Low-BM	0.3129	2.5987	0.0102	0.0322
BM-2	0.4971	3.3476	0.0010	0.0557
BM-3	0.2240	2.1934	0.0296	0.0216
BM-4	0.4145	3.2320	0.0015	0.0518
High-BM	0.5176	4.4984	0.0000	0.1001

Low-MMT	0.4898	1.5687	0.1186	0.0084
MMT-2	0.8298	3.5802	0.0004	0.0639
MMT-3	0.3112	1.5061	0.1339	0.0073
MMT-4	0.5003	2.4548	0.0151	0.0282
High-MMT	1.0968	7.2393	0.0000	0.2291

Table VIIB

Single Factor Model Regressions on Sequentially Sorted Portfolios

For the 8 sequentially sorted portfolios based on size, BM and momentum, monthly excess returns are regressed on monthly market excess returns using the regression model: $ER_{p_i,t} = \alpha + (R_{m,t} - R_{p_i,t})\beta + \varepsilon_i$. The slope coefficient for each portfolio, the associated *t*-statistic, *p*-value and the adjusted r-square are reported in the table.

	Coefficient	***t*-value**	***p*-value**	**R-square**
BLL	0.6330	16.5559	0.0000	0.6122
BLW	0.6023	14.7030	0.0000	0.5543
BHL	0.8198	13.6003	0.0000	0.5154
BHW	0.7539	3.9647	0.0001	0.0784
SLL	0.4129	6.4713	0.0000	0.1911
SLW	0.3879	6.0417	0.0000	0.1703
SHL	0.4018	3.6743	0.0003	0.0674
SHW	0.4091	2.1400	0.0338	0.0203

Table VIIIA

Three-Factor Model Regressions on Single Risk Factor Portfolios with Factor Returns Computed Using 27-Stock Portfolios

For the 15 portfolios formed on basis of size, BM and momentum, the excess returns are regressed on market premium, size premium (SML) and BM premium (HML) using the regression model: $ER_{p_i,t} = \alpha + \gamma\beta_{p_i,t} + \pi SMB_t + HML_t + \varepsilon_i$. Factor returns for size and BM are computed using the portfolios with 20% most risky stocks and 20% least risky stocks. The three slope coefficients for each portfolio, the associated *t*-statistics, *p*-values and the adjusted r-square values are reported in the table.

	Beta coefficient	*t*-value	*p*-value	Size coefficient	*t*-value	*p*-value	BM Coefficient	*t*-value	*p*-value	R-square
Small-Size	0.9839	2.8629	0.0047	0.2178	1.0435	0.2982	0.4785	1.6430	0.1022	0.0864
Size-2	1.2432	4.0225	0.0001	0.2020	1.0762	0.2834	0.8604	3.2851	0.0012	0.2070
Size-3	0.5116	1.8879	0.0607	0.1581	0.9607	0.3381	0.4675	2.0356	0.0433	0.0820
Size-4	0.7183	1.5284	0.1283	0.4796	1.6805	0.0947	0.0236	0.0592	0.9529	0.0242
Large-Size	0.6296	1.8186	0.0707	0.3538	1.6829	0.0942	0.0341	0.1163	0.9075	0.0300
Low-BM	0.3583	2.9062	0.0041	0.1200	1.6036	0.1107	-0.0885	-0.8472	0.3981	0.0364
BM-2	0.5093	3.3544	0.0010	0.0529	0.5738	0.5669	-0.2074	-1.6124	0.1087	0.0626
BM-3	0.2200	2.1157	0.0358	-0.0280	-0.4440	0.6576	0.1604	1.8201	0.0705	0.0371
BM-4	0.4472	3.3901	0.0009	0.0884	1.1039	0.2712	-0.0822	-0.7356	0.4630	0.0475
High-BM	0.4969	4.2050	0.0000	-0.0464	-0.6465	0.5188	-0.0335	-0.3344	0.7385	0.0985
Low-MMT	0.5341	1.6660	0.0976	0.0914	0.4692	0.6395	0.1433	0.5274	0.5986	0.0068
MMT-2	0.8073	3.4287	0.0008	-0.1014	-0.7094	0.4790	0.4137	2.0736	0.0396	0.0825
MMT-3	0.3725	1.7597	0.0803	0.1499	1.1658	0.2453	-0.0109	-0.0609	0.9515	0.0104
MMT-4	0.5739	2.7489	0.0066	0.2036	1.6059	0.1101	-0.2227	-1.2586	0.2099	0.0316
High-MMT	1.0888	7.0044	0.0000	-0.0382	-0.4042	0.6866	0.1648	1.2508	0.2127	0.2293

Table VIIIB

Three-Factor Model Regressions on Single Risk Factor Portfolios with Factor Returns Computed Using 15-Stock Portfolios

For the 15 portfolios formed on basis of size, BM and momentum, the excess returns are regressed on market premium, size premium (SML) and BM premium (HML) using the regression model: $ER_{p_i,t} = \alpha + \gamma\beta_{p_i,t} + \pi SMB_t + HML_t + \varepsilon_i$. Factor returns for size and BM are computed using the portfolios with 15 most risky stocks and 15 least risky stocks. The three slope coefficients for each portfolio, the associated *t*-statistics, *p*-values and the adjusted r-square values are reported in the table.

	Beta coefficient	*t*-value	*p*-value	Size coefficient	*t*-value	*p*-value	BM Coefficient	*t*-value	*p*-value	R-square
Small-Size	1.4778	4.7682	0.0000	1.6557	7.0633	0.0000	-0.4144	-1.6010	0.1112	0.2913
Size-2	1.5314	5.4692	0.0000	1.2718	6.0056	0.0000	0.4044	1.7294	0.0856	0.3792
Size-3	0.5428	2.0963	0.0375	0.4818	2.4605	0.0149	0.6599	3.0513	0.0026	0.2009
Size-4	1.0727	2.3449	0.0202	1.5095	4.3628	0.0000	-0.3869	-1.0126	0.3127	0.1183
Large-Size	1.1666	3.7125	0.0003	1.7401	7.3217	0.0000	-1.0727	-4.0872	0.0001	0.2379
Low-BM	0.3138	2.4668	0.0146	0.0058	0.0602	0.9520	0.0142	0.1337	0.8938	0.0211
BM-2	0.5763	3.7660	0.0002	0.1491	1.2884	0.1994	-0.3669	-2.8711	0.0046	0.0917
BM-3	0.3083	2.9674	0.0034	0.2361	3.0052	0.0031	-0.0298	-0.3435	0.7316	0.0830
BM-4	0.5096	3.8195	0.0002	0.2265	2.2448	0.0261	-0.2194	-1.9694	0.0505	0.0706
High-BM	0.4869	4.0175	0.0001	-0.0843	-0.9197	0.3591	0.0186	0.1838	0.8544	0.0956
Low-MMT	0.6579	2.0542	0.0415	0.5119	2.1134	0.0360	0.1308	0.4891	0.6254	0.0550
MMT-2	0.9082	3.8575	0.0002	0.2893	1.6249	0.1060	0.2966	1.5084	0.1333	0.1251
MMT-3	0.4810	2.2807	0.0238	0.4705	2.9500	0.0036	-0.0850	-0.4825	0.6301	0.0632
MMT-4	0.6648	3.1450	0.0020	0.3922	2.4530	0.0152	-0.3785	-2.1440	0.0335	0.0532
High-MMT	1.2065	7.7783	0.0000	0.3109	2.6499	0.0088	-0.0227	-0.1750	0.8613	0.2681

Table VIIIC

Three-Factor Model Regressions on Sequentially Sorted Portfolios

For the 8 portfolios sorted sequentially, the excess returns are regressed on market premium, size premium (SML) and BM premium (HML) using the regression model: $ER_{p_i,t} = \alpha + \gamma\beta_{p_i,t} + \pi SMB_t + HML_t + \varepsilon_i$. Factor returns for size and BM are computed using the methodology given by Liew and Vassalou (2000). The three slope coefficients for each portfolio, the associated *t*-statistics, *p*-values and the adjusted r-square values are reported in the table.

	Market Premium coefficient	*t*-value	*p*-value	Size coefficient	*t*-value	*p*-value	BM Coefficient	*t*-value	*p*-value	R-square
BLL	0.6202	15.4479	0.0000	-0.0394	-1.0771	0.2830	0.0117	0.3030	0.7623	0.6103
BLW	0.6063	14.1654	0.0000	0.0298	0.7655	0.4450	0.0566	1.3741	0.1712	0.5566
BHL	0.7922	13.1115	0.0000	-0.0208	-0.3783	0.7057	0.2451	4.2132	0.0000	0.5562
BHW	0.1505	1.6276	0.1055	-1.4879	-17.6594	0.0000	1.8134	20.3594	0.0000	0.8013
SLL	0.4961	7.8910	0.0000	0.2788	4.8695	0.0000	0.0035	0.0570	0.9546	0.2844
SLW	0.4467	6.8903	0.0000	0.2124	3.5973	0.0004	0.0551	0.8830	0.3785	0.2291
SHL	0.5218	5.9092	0.0000	0.5747	7.1451	0.0000	0.5970	7.0203	0.0000	0.4457
SHW	0.7047	8.2328	0.0000	1.4157	18.1561	0.0000	1.4714	17.8500	0.0000	0.8210

Table IXA

Four-Factor Model Regressions on Single Risk Factor Portfolios with Factor Returns Computed Using 27-Stock Portfolios

For the 15 portfolios formed on basis of size, BM and momentum, the excess returns are regressed on market premium, size premium (SML), BM premium (HML) and premium for 1-year momentum (WML) using the regression model: $ER_{p_i,t} = \alpha + \gamma\beta_{p_i,t} + \pi SMB_t + \mu HML_t + \Omega WML_T + \varepsilon_i$. Factor returns for size, BM and momentum are computed using the portfolios with 27 most risky stocks and 27 least risky stocks. The four slope coefficients for each portfolio, the associated *t*-statistics, *p*-values and the r-square values are reported in the table.

	Market Premium			Size			HML			WML			R-square
	coefficient	*t*-value	*p*-value	coefficient	*t*-value	*p*-value	Coefficient	*t*-value	*p*-value	coefficient	*t*-value	*p*-value	
Small-Size	0.9223	2.8607	0.0048	0.3254	1.6528	0.1002	0.9581	3.3067	0.0012	-1.1796	-4.9418	0.0000	0.1970
Size-2	1.1724	4.2437	0.0000	0.3259	1.9320	0.0550	1.4126	5.6898	0.0000	-1.3581	-6.6403	0.0000	0.3673
Size-3	0.4950	1.8333	0.0685	0.1873	1.1360	0.2576	0.5975	2.4624	0.0148	-0.3196	-1.5991	0.1117	0.0903
Size-4	0.7203	1.5270	0.1286	0.4761	1.6532	0.1002	0.0080	0.0189	0.9850	0.0383	0.1097	0.9128	0.0185
Large-Size	0.6032	1.7561	0.0809	0.3999	1.9069	0.0582	0.2397	0.7765	0.4385	-0.5056	-1.9882	0.0484	0.0466
Low-BM	0.3556	2.8767	0.0045	0.1247	1.6520	0.1004	-0.0678	-0.6104	0.5424	-0.0509	-0.5559	0.5790	0.0324
BM-2	0.5113	3.3565	0.0010	0.0493	0.5305	0.5965	-0.2233	-1.6312	0.1047	0.0390	0.3460	0.7298	0.0577
BM-3	0.2146	2.0674	0.0402	-0.0187	-0.2944	0.7688	0.2021	2.1668	0.0316	-0.1028	-1.3372	0.1829	0.0415
BM-4	0.4486	3.3890	0.0009	0.0859	1.0635	0.2891	-0.0933	-0.7842	0.4340	0.0272	0.2775	0.7817	0.0423
High-BM	0.5024	4.2553	0.0000	-0.0561	-0.7787	0.4372	-0.0770	-0.7253	0.4693	0.1069	1.2233	0.2229	0.1011
Low-MMT	0.4816	1.5826	0.1154	0.1832	0.9861	0.3255	0.5528	2.0214	0.0448	-1.0071	-4.4703	0.0000	0.1065
MMT-2	0.7704	3.4300	0.0008	-0.0369	-0.2693	0.7880	0.7012	3.4741	0.0007	-0.7071	-4.2528	0.0000	0.1663
MMT-3	0.3455	1.6808	0.0946	0.1971	1.5710	0.1181	0.1998	1.0820	0.2808	-0.5183	-3.4067	0.0008	0.0686
MMT-4	0.5669	2.7115	0.0074	0.2158	1.6903	0.0928	-0.1684	-0.8961	0.3714	-0.1335	-0.8624	0.3897	0.0302
High-MMT	1.0610	7.2747	0.0000	0.0105	0.1179	0.9063	0.3817	2.9119	0.0041	-0.5334	-4.9405	0.0000	0.3225

Table IXB

Four-Factor Model Regressions on Single Risk Factor Portfolios with Factor Returns Computed Using 15-Stock Portfolios

For the 15 portfolios formed on basis of size, BM and momentum, the excess returns are regressed on market premium, size premium (SML), BM premium (HML) and premium for 1-year momentum (WML) using the regression model: $ER_{p_i,t} = \alpha + \gamma\beta_{p_i,t} + \pi SMB_t + \mu HML_t + \Omega WML_T + \varepsilon_i$. Factor returns for size, BM and momentum are computed using the portfolios with 15 most risky stocks and 15 least risky stocks. The four slope coefficients for each portfolio, the associated *t*-statistics, *p*-values and the r-square values are reported in the table.

	Market Premium			Size			HML			WML			R-square
	coefficient	*t*-value	*p*-value	coefficient	*t*-value	*p*-value	Coefficient	*t*-value	*p*-value	Coefficient	*t*-value	*p*-value	
Small-Size	1.4516	4.6659	0.0000	1.6179	6.8103	0.0000	-0.3770	-1.4409	0.1514	-0.1126	-0.9819	0.3275	0.2912
Size-2	1.4959	5.3413	0.0000	1.2206	5.7076	0.0000	0.4550	1.9318	0.0551	-0.1524	-1.4771	0.1415	0.3835
Size-3	0.5556	2.1337	0.0343	0.5003	2.5162	0.0128	0.6416	2.9294	0.0039	0.0551	0.5742	0.5666	0.1977
Size-4	1.1486	2.5219	0.0126	1.6190	4.6551	0.0000	-0.4952	-1.2927	0.1979	0.3262	1.9437	0.0536	0.1325
Large-Size	1.1841	3.7476	0.0002	1.7653	7.3168	0.0000	-1.0976	-4.1304	0.0001	0.0749	0.6435	0.5207	0.2352
Low-BM	0.3135	2.4477	0.0154	0.0053	0.0540	0.9570	0.0147	0.1366	0.8915	-0.0015	-0.0325	0.9741	0.0153
BM-2	0.5675	3.6887	0.0003	0.1364	1.1611	0.2472	-0.3544	-2.7388	0.0068	-0.0379	-0.6677	0.5052	0.0888
BM-3	0.3137	3.0024	0.0031	0.2439	3.0573	0.0026	-0.0375	-0.4267	0.6702	0.0231	0.6012	0.5485	0.0795
BM-4	0.5124	3.8160	0.0002	0.2306	2.2488	0.0258	-0.2235	-1.9788	0.0495	0.0121	0.2452	0.8066	0.0655
High-BM	0.4885	4.0048	0.0001	-0.0819	-0.8792	0.3805	0.0162	0.1583	0.8744	0.0071	0.1585	0.8742	0.0903
Low-MMT	0.1875	0.5641	0.5735	0.1293	0.7296	0.4667	0.6660	2.5018	0.0134	-1.0419	-4.8118	0.0000	0.1207
MMT-2	0.7479	2.8327	0.0052	-0.0169	-0.1198	0.9048	0.7152	3.3819	0.0009	-0.7368	-4.2832	0.0000	0.1648
MMT-3	0.3951	1.6509	0.1008	0.1873	1.4675	0.1442	0.1508	0.7864	0.4328	-0.4967	-3.1856	0.0017	0.0622
MMT-4	0.4670	1.8924	0.0603	0.1959	1.4879	0.1388	-0.1313	-0.6640	0.5077	-0.1502	-0.9340	0.3518	0.0104
High-MMT	0.8780	5.3214	0.0000	-0.0014	-0.0157	0.9875	0.4528	3.4264	0.0008	-0.5682	-5.2852	0.0000	0.2860

Table IXC

Four-Factor Model Regressions on Sequentially Sorted Portfolios

For the 8 portfolios sorted sequentially, the excess returns are regressed on market premium, size premium (SML), BM premium (HML) and premium for 1-year momentum (WML) using the regression model: $ER_{p_{i,t}} = \alpha + \gamma\beta_{p_{i,t}} + \pi SMB_t + \mu HML_t + \Omega WML_T + \varepsilon_i$. Factor returns for size, BM and momentum are computed using the methodology given by Liew and Vassalou (2000). The four slope coefficients for each portfolio, the associated *t*-statistics, *p*-values and the r-square values are reported in the table.

	Market Premium			Size			HML			WML			R-square
	coefficient	*t*-value	*p*-value	coefficient	*t*-value	*p*-value	Coefficient	*t*-value	*p*-value	coefficient	*t*-value	*p*-value	
BLL	0.6099	14.9829	0.0000	-0.0517	-1.3769	0.1704	0.0617	1.1721	0.2428	-0.0787	-1.3949	0.1649	0.6125
BLW	0.6163	14.1851	0.0000	0.0417	1.0420	0.2989	0.0083	0.1473	0.8830	0.0762	1.2650	0.2076	0.5582
BHL	0.7234	13.3389	0.0000	-0.1029	-2.0595	0.0410	0.5797	8.2674	0.0000	-0.5270	-7.0093	0.0000	0.6541
BHW	0.2411	2.7992	0.0057	-1.3798	-17.3868	0.0000	1.3731	12.3337	0.0000	0.6936	5.8102	0.0000	0.8334
SLL	0.4790	7.5199	0.0000	0.2584	4.4029	0.0000	0.0866	1.0512	0.2947	-0.1309	-1.4827	0.1400	0.2894
SLW	0.4855	7.5843	0.0000	0.2588	4.3867	0.0000	-0.1338	-1.6162	0.1079	0.2975	3.3528	0.0010	0.2729
SHL	0.3784	5.7116	0.0000	0.4034	6.6088	0.0000	1.2948	15.1198	0.0000	-1.0993	-11.9717	0.0000	0.6983
SHW	0.8479	13.5491	0.0000	1.5866	27.5129	0.0000	0.7751	9.5812	0.0000	1.0968	12.6438	0.0000	0.9075

Table XA

Single Factor Model Regressions on Single Risk Factor Based Portfolios Using Normal Period Data

For the 15 portfolios formed on basis of size, BM and momentum, monthly excess returns are regressed on monthly market excess returns using the regression model: $ER_{p_i,t} = \alpha + (R_{m,t} - R_{p_i,t})\beta + \varepsilon_i$. The period over which the equity market was following extreme downward trend is excluded for this analysis. The slope coefficient for each portfolio, the associated *t*-statistic, *p*-value and the adjusted r-square are reported in the table.

	Coefficient	***t*-value**	***p*-value**	**R-square**
Small-Size	0.6775	1.68143	0.09463	0.01736
Size-2	1.35011	3.4995	0.0006	0.0711
Size-3	0.69553	2.19146	0.02986	0.02914
Size-4	0.77585	1.43026	0.15459	0.01262
Large-Size	0.95511	2.54667	0.01182	0.03896
Low-BM	0.41517	2.94715	0.00369	0.04556
BM-2	0.48131	2.8209	0.0054	0.04142
BM-3	0.37587	3.43848	0.00075	0.06299
BM-4	0.42271	2.87037	0.00465	0.04303
High-BM	0.49987	4.30838	2.9E-05	0.09835
Low-MMT	0.3081	0.89484	0.37222	-0.0012
MMT-2	0.89162	3.27326	0.0013	0.0569
MMT-3	0.39574	1.65827	0.09922	0.01075
MMT-4	0.40496	1.69107	0.09277	0.01142
High-MMT	0.97578	5.61346	8.6E-08	0.15932

Table XB

Single Factor Model Regressions on Sequentially Sorted Portfolios Using Normal Period Data

For the 8 sequentially sorted portfolios based on size, BM and momentum, monthly excess returns are regressed on monthly market excess returns using the regression model: $ER_{p_i,t} = \alpha + (R_{m,t} - R_{p_i,t})\beta + \varepsilon_i$. The period over which the equity market was following extreme downward trend is excluded for this analysis. The slope coefficient for each portfolio, the associated *t*-statistic, *p*-value and the adjusted r-square are reported in the table.

	Coefficient	***t*-value**	***p*-value**	**R-square**
BLL	0.5928	15.1408	0.0000	0.5864
BLW	0.6313	13.7358	0.0000	0.5382
BHL	0.8935	13.1313	0.0000	0.5157
BHW	0.8289	3.6888	0.0003	0.0726
SLL	0.4091	5.5004	0.0000	0.1538
SLW	0.4400	5.9613	0.0000	0.1766
SHL	0.5172	4.2088	0.0000	0.0940
SHW	0.5442	2.4373	0.0159	0.0298

Table XIA

Three-Factor Model Regressions on Single Risk Factor Portfolios with Factor Returns Computed Using 27-Stock Portfolios Estimated for Normal Period

For the 15 portfolios formed on basis of size, BM and momentum, the excess returns are regressed on market premium, size premium (SML) and BM premium (HML) using the regression model: $ER_{p_i,t} = \alpha + \gamma\beta_{p_i,t} + \pi SMB_t + HML_t + \varepsilon_i$. Factor returns for size and BM are computed using the portfolios with 20% most risky stocks and 20% least risky stocks. The period over which the equity market was following extreme downward trend is excluded for this analysis. The three slope coefficients for each portfolio, the associated *t*-statistics, *p*-values and the adjusted r-square values are reported in the table.

	Beta coefficient	*t*-value	*p*-value	Size coefficient	*t*-value	*p*-value	BM Coefficient	*t*-value	*p*-value	R-square
Small-Size	0.6866	1.7184	0.0877	0.1922	0.9052	0.3667	0.5771	1.9220	0.0564	0.0790
Size-2	1.3404	3.6676	0.0003	0.2107	1.0845	0.2798	0.8422	3.0665	0.0025	0.2053
Size-3	0.7142	2.2565	0.0254	0.1680	0.9984	0.3196	0.3897	1.6384	0.1033	0.0797
Size-4	0.9472	1.7170	0.0879	0.5065	1.7274	0.0860	-0.0551	-0.1330	0.8943	0.0265
Large-Size	1.0907	2.8599	0.0048	0.3820	1.8845	0.0613	-0.1100	-0.3836	0.7018	0.0525
Low-BM	0.4678	3.2386	0.0015	0.1243	1.6193	0.1074	-0.1266	-1.1660	0.2454	0.0493
BM-2	0.5200	2.9759	0.0034	0.0580	0.6247	0.5331	-0.2097	-1.5971	0.1122	0.0476
BM-3	0.3590	3.1897	0.0017	-0.0257	-0.4303	0.6675	0.0905	1.0704	0.2861	0.0592
BM-4	0.4678	3.0895	0.0024	0.1056	1.3120	0.1914	-0.1119	-0.9836	0.3268	0.0414
High-BM	0.4733	3.9829	0.0001	-0.0799	-1.2653	0.2076	0.0041	0.0457	0.9636	0.1040
Low-MMT	0.2997	0.8468	0.3984	0.0357	0.1899	0.8496	0.2146	0.8067	0.4211	-0.0026
MMT-2	0.8273	2.9818	0.0033	-0.0831	-0.5633	0.5741	0.3960	1.8992	0.0594	0.0731
MMT-3	0.4486	1.8270	0.0696	0.1427	1.0936	0.2758	-0.0644	-0.3492	0.7274	0.0079
MMT-4	0.4832	1.9636	0.0513	0.1824	1.3944	0.1652	-0.1963	-1.0617	0.2900	0.0112
High-MMT	0.9392	5.2747	0.0000	-0.0524	-0.5539	0.5804	0.2067	1.5446	0.1245	0.1643

Table XIB

Three-Factor Model Regressions on Single Risk Factor Portfolios with Factor Returns Computed Using 15-Stock Portfolios Estimated for Normal Period

For the 15 portfolios formed on basis of size, BM and momentum, the excess returns are regressed on market premium, size premium (SML) and BM premium (HML) using the regression model: $ER_{p_i,t} = \alpha + \gamma\beta_{p_i,t} + \pi SMB_t + HML_t + \varepsilon_i$. Factor returns for size and BM are computed using the portfolios with 15 most risky stocks and 15 least risky stocks. The period over which the equity market was following extreme downward trend is excluded for this analysis. The three slope coefficients for each portfolio, the associated *t*-statistics, *p*-values and the adjusted r-square values are reported in the table.

	Beta coefficient	*t*-value	*p*-value	Size coefficient	*t*-value	*p*-value	BM Coefficient	*t*-value	*p*-value	R-square
Small-Size	1.0949	3.1991	0.0017	1.8791	7.7190	0.0000	-0.4302	-1.6582	0.0993	0.3295
Size-2	1.5078	4.6919	0.0000	1.3456	5.8867	0.0000	0.4382	1.7987	0.0740	0.3905
Size-3	0.6612	2.2149	0.0282	0.4686	2.2072	0.0287	0.6244	2.7595	0.0065	0.1878
Size-4	1.1182	2.1208	0.0355	1.5437	4.1162	0.0001	-0.3504	-0.8767	0.3820	0.1179
Large-Size	1.4248	4.1208	0.0001	1.5937	6.4801	0.0000	-0.9760	-3.7237	0.0003	0.2275
Low-BM	0.4043	2.7674	0.0063	-0.0467	-0.4495	0.6537	0.0130	0.1176	0.9065	0.0350
BM-2	0.5726	3.3112	0.0012	0.1399	1.1370	0.2572	-0.3504	-2.6732	0.0083	0.0745
BM-3	0.4115	3.6845	0.0003	0.1583	1.9934	0.0479	-0.0384	-0.4542	0.6503	0.0809
BM-4	0.5172	3.4544	0.0007	0.2567	2.4100	0.0171	-0.2569	-2.2637	0.0250	0.0703
High-BM	0.4570	3.8335	0.0002	-0.1505	-1.7749	0.0778	0.0841	0.9304	0.3536	0.1052
Low-MMT	0.4122	1.1979	0.2328	0.6328	2.5853	0.0106	0.0477	0.1830	0.8550	0.0600
MMT-2	0.8915	3.2891	0.0012	0.3229	1.6749	0.0959	0.3059	1.4887	0.1386	0.1224
MMT-3	0.4974	2.0600	0.0410	0.4417	2.5719	0.0110	-0.1199	-0.6551	0.5134	0.0482
MMT-4	0.5422	2.2186	0.0279	0.3907	2.2476	0.0260	-0.3561	-1.9221	0.0564	0.0323
High-MMT	1.0491	6.0780	0.0000	0.3782	3.0807	0.0024	-0.0301	-0.2303	0.8181	0.2209

Table XIC

Three-Factor Model Regressions on Sequentially Sorted Portfolios with Factor Returns Computed Using 27-Stock Portfolios Estimated for Normal Period

For the 8 portfolios sorted sequentially, the excess returns are regressed on market premium, size premium (SML) and BM premium (HML) using the regression model: $ER_{p_i,t} = \alpha + \gamma\beta_{p_i,t} + \pi SMB_t + HML_t + \varepsilon_i$. Factor returns for size and BM are computed using the methodology given by Liew and Vassalou (2000). The period over which the equity market was following extreme downward trend in excluded for this analysis. The three slope coefficients for each portfolio, the associated *t*-statistics, *p*-values and the adjusted r-square values are reported in the table.

	Market Premium coefficient	*t*-value	*p*-value	Size coefficient	*t*-value	*p*-value	BM Coefficient	*t*-value	*p*-value	R-square
BLL	0.5851	14.2969	0.0000	-0.0132	-0.3970	0.6919	0.0241	0.6795	0.4978	0.5826
BLW	0.6303	13.1218	0.0000	0.0144	0.3678	0.7135	0.0269	0.6457	0.5194	0.5342
BHL	0.8508	12.4328	0.0000	-0.0169	-0.3036	0.7619	0.2156	3.6388	0.0004	0.5476
BHW	0.1162	1.0796	0.2819	-1.5147	-17.3098	0.0000	1.8037	19.3575	0.0000	0.8036
SLL	0.4799	6.5597	0.0000	0.2710	4.5561	0.0000	-0.0034	-0.0537	0.9572	0.2438
SLW	0.4871	6.5217	0.0000	0.1974	3.2507	0.0014	0.0227	0.3505	0.7264	0.2213
SHL	0.5639	5.5721	0.0000	0.5561	6.7590	0.0000	0.5481	6.2555	0.0000	0.4326
SHW	0.6515	6.5952	0.0000	1.4450	17.9915	0.0000	1.5029	17.5724	0.0000	0.8246

Table XIIA

Four-Factor Model Regressions on Single Risk Factor Portfolios with Factor Returns Computed Using 27-Stock Portfolios Estimated for Normal Period

For the 15 portfolios formed on basis of size, BM and momentum, the excess returns are regressed on market premium, size premium (SML), BM premium (HML) and premium for 1-year momentum (WML) using the regression model: $ER_{p_i,t} = \alpha + \gamma\beta_{p_i,t} + \pi SMB_t + \mu HML_t + \Omega WML_T + \varepsilon_i$. Factor returns for size, BM and momentum are computed using the portfolios with 27 most risky stocks and 27 least risky stocks. The period over which the equity market was following extreme downward trend is excluded for this analysis. The four slope coefficients for each portfolio, the associated *t*-statistics, *p*-values and the r-square values are reported in the table.

	Market Premium			Size			HML			WML			R-square
	coefficient	*t*-value	*p*-value	coefficient	*t*-value	*p*-value	Coefficient	*t*-value	*p*-value	coefficient	*t*-value	*p*-value	
Small-Size	0.5492	1.4834	0.1400	0.3068	1.5534	0.1223	1.1294	3.8085	0.0002	-1.2748	-5.2851	0.0000	0.2131
Size-2	1.1903	3.6561	0.0003	0.3358	1.9334	0.0550	1.4455	5.5429	0.0000	-1.3925	-6.5646	0.0000	0.3725
Size-3	0.6846	2.1631	0.0320	0.1926	1.1406	0.2558	0.5084	2.0052	0.0467	-0.2740	-1.3284	0.1860	0.0841
Size-4	0.9542	1.7201	0.0874	0.5007	1.6921	0.0926	-0.0832	-0.1873	0.8517	0.0648	0.1793	0.8579	0.0205
Large-Size	1.0342	2.7351	0.0070	0.4291	2.1274	0.0350	0.1172	0.3868	0.6994	-0.5242	-2.1278	0.0349	0.0732
Low-BM	0.4642	3.1966	0.0017	0.1274	1.6442	0.1021	-0.1120	-0.9626	0.3372	-0.0337	-0.3565	0.7219	0.0440
BM-2	0.5226	2.9744	0.0034	0.0558	0.5958	0.5522	-0.2202	-1.5647	0.1197	0.0242	0.2116	0.8327	0.0418
BM-3	0.3526	3.1220	0.0021	-0.0205	-0.3395	0.7347	0.1160	1.2825	0.2015	-0.0589	-0.8000	0.4249	0.0570
BM-4	0.4715	3.0969	0.0023	0.1026	1.2634	0.2083	-0.1265	-1.0370	0.3013	0.0335	0.3380	0.7358	0.0360
High-BM	0.4841	4.0732	0.0001	-0.0890	-1.4034	0.1625	-0.0396	-0.4161	0.6779	0.1009	1.3024	0.1947	0.1079
Low-MMT	0.1875	0.5641	0.5735	0.1293	0.7296	0.4667	0.6660	2.5018	0.0134	-1.0419	-4.8118	0.0000	0.1207
MMT-2	0.7479	2.8327	0.0052	-0.0169	-0.1198	0.9048	0.7152	3.3819	0.0009	-0.7368	-4.2832	0.0000	0.1648
MMT-3	0.3951	1.6509	0.1008	0.1873	1.4675	0.1442	0.1508	0.7864	0.4328	-0.4967	-3.1856	0.0017	0.0622
MMT-4	0.4670	1.8924	0.0603	0.1959	1.4879	0.1388	-0.1313	-0.6640	0.5077	-0.1502	-0.9340	0.3518	0.0104
High-MMT	0.8780	5.3214	0.0000	-0.0014	-0.0157	0.9875	0.4528	3.4264	0.0008	-0.5682	-5.2852	0.0000	0.2860

Table XIIB

Four-Factor Model Regressions on Single Risk Factor Portfolios with Factor Returns Computed Using 15-Stock Portfolios Estimated for Normal Period

For the 15 portfolios formed on basis of size, BM and momentum, the excess returns are regressed on market premium, size premium (SML), BM premium (HML) and premium for 1-year momentum (WML) using the regression model: $ER_{p_i,t} = \alpha + \gamma\beta_{p_i,t} + \pi SMB_t + \mu HML_t + \Omega WML_T + \varepsilon_i$. Factor returns for size, BM and momentum are computed using the portfolios with 15 most risky stocks and 15 least risky stocks. The period over which the equity market was following extreme downward trend is excluded for this analysis. The four slope coefficients for each portfolio, the associated *t*-statistics, *p*-values and the r-square values are reported in the table.

	Market Premium			Size			HML			WML			R-square
	coefficient	*t*-value	*p*-value	coefficient	*t*-value	*p*-value	Coefficient	*t*-value	*p*-value	coefficient	*t*-value	*p*-value	
Small-Size	1.07295	3.12184	0.00214	1.84185	7.42636	6.7E-12	-0.3958	-1.50424	0.13454	-0.0918	-0.81045	0.41895	0.32805
Size-2	1.47295	4.58209	9.3E-06	1.28642	5.54555	1.2E-07	0.49267	2.00166	0.04704	-0.1457	-1.37492	0.17112	0.39388
Size-3	0.67664	2.25563	0.02548	0.49496	2.28649	0.02356	0.60018	2.61305	0.00985	0.06477	0.65503	0.51341	0.18485
Size-4	1.20008	2.29008	0.02335	1.68286	4.45017	1.6E-05	-0.4786	-1.1927	0.23478	0.34257	1.98329	0.04908	0.13397
Large-Size	1.43736	4.13395	5.8E-05	1.6151	6.43706	1.4E-09	-0.9957	-3.74016	0.00026	0.05274	0.46022	0.64599	0.22367
Low-BM	0.4025	2.73776	0.00694	-0.0499	-0.47	0.63904	0.01591	0.14137	0.88776	-0.0077	-0.1594	0.87356	0.02903
BM-2	0.56127	3.23222	0.00151	0.12056	0.96209	0.33749	-0.3326	-2.5019	0.01338	-0.0475	-0.8303	0.40761	0.07263
BM-3	0.41623	3.70739	0.00029	0.16646	2.05458	0.04158	-0.0459	-0.5342	0.59396	0.01998	0.53985	0.59005	0.0768
BM-4	0.52086	3.45788	0.00074	0.26284	2.4181	0.01675	-0.2626	-2.277	0.02414	0.01518	0.30577	0.76019	0.06489
High-BM	0.4561	3.80174	0.00021	-0.1521	-1.7572	0.08084	0.08556	0.93147	0.35304	-0.004	-0.1001	0.92045	0.09955
Low-MMT	0.33152	0.98517	0.32605	0.49568	2.04123	0.04293	0.17403	0.67543	0.50039	-0.3375	-3.0426	0.00275	0.10673
MMT-2	0.85118	3.15632	0.00192	0.25445	1.30749	0.19296	0.36891	1.78662	0.07593	-0.1685	-1.8955	0.05987	0.13662
MMT-3	0.46574	1.93367	0.05495	0.38792	2.23186	0.02704	-0.0703	-0.3814	0.70344	-0.1325	-1.6684	0.09723	0.0588
MMT-4	0.52975	2.15684	0.03254	0.36955	2.08502	0.03869	-0.3366	-1.7898	0.07541	-0.0521	-0.6437	0.52069	0.02866
High-MMT	1.01773	5.95983	1.6E-08	0.32492	2.63672	0.00921	0.01896	0.14502	0.88488	-0.1312	-2.3312	0.02101	0.24221

Table XIIC

Four-Factor Model Regressions on Sequentially Sorted Portfolios with Factor Returns Computed Using 27-Stock Portfolios Estimated for Normal Period

For the 8 portfolios sorted sequentially, the excess returns are regressed on market premium, size premium (SML), BM premium (HML) and premium for 1-year momentum (WML) using the regression model: $ER_{p_i,t} = \alpha + \gamma\beta_{p_i,t} + \pi SMB_t + \mu HML_t + \Omega WML_T + \varepsilon_i$. Factor returns for size, BM and momentum are computed using the methodology given by Liew and Vassalou (2000). The period over which the equity market was following extreme downward trend is excluded for this analysis. The four slope coefficients for each portfolio, the associated *t*-statistics, *p*-values and the r-square values are reported in the table.

	Market Premium			Size			HML			WML			R-square
	coefficient	*t*-value	*p*-value	coefficient	*t*-value	*p*-value	Coefficient	*t*-value	*p*-value	coefficient	*t*-value	*p*-value	
BLL	0.5792	13.8955	0.0000	-0.0197	-0.5725	0.5678	0.0495	1.0202	0.3092	-0.0395	-0.7682	0.4435	0.5815
BLW	0.6427	13.1909	0.0000	0.0280	0.6970	0.4868	-0.0267	-0.4705	0.6387	0.0832	1.3854	0.1679	0.5369
BHL	0.7752	12.5859	0.0000	-0.1001	-1.9721	0.0504	0.5425	7.5717	0.0000	-0.5084	-6.6939	0.0000	0.6458
BHW	0.2203	2.2016	0.0292	-1.4001	-16.9752	0.0000	1.3536	11.6324	0.0000	0.7000	5.6745	0.0000	0.8359
SLL	0.4611	6.2133	0.0000	0.2503	4.0908	0.0001	0.0781	0.9052	0.3668	-0.1268	-1.3859	0.1678	0.2482
SLW	0.5344	7.2833	0.0000	0.2495	4.1252	0.0001	-0.1821	-2.1332	0.0345	0.3184	3.5194	0.0006	0.2736
SHL	0.4018	5.3282	0.0000	0.3777	6.0742	0.0000	1.2488	14.2358	0.0000	-1.0899	-11.7197	0.0000	0.6954
SHW	0.8200	11.8636	0.0000	1.6307	28.6162	0.0000	0.7740	9.6269	0.0000	1.1337	13.3010	0.0000	0.9170

5. CONCLUSION

Fama and French (1992) reported that the two fundamental factors, size and BM explains the cross-sectional variation in stock returns and the relationship between beta and average return is flat. This seminal work of Fama and French rendered the relationship between risk and return as predicted by CAPM completely false. Most literature on stock returns in developed markets confirms this finding, but the findings from emerging markets are diverse. Like Firozjaee and Jelodar (2010), Al-Mwalla (2012) and Eraslan (2013), this study finds that the market risk is the most significantly priced factor in stock returns for Pakistani stocks. Moreover, small stocks outperform big stocks, value stocks outperform growth stocks and there are momentum profits. In short, investors in Pakistani market are compensated for the size, BM and momentum factors, but the relationship between risk and return as given by CAPM is strong and remains powerful even with the addition of size, BM and momentum factors.

It can be argued that these findings are sample-specific, as the results are based on short period and a small number of companies. However, the study went back as far as possible and includes all non-financial companies for which the required data was available. The study is based on the sample of surviving firms only and results might have been affected by the survivorship bias; however, we have no way to correct for this bias as the data for the non-surviving Pakistani companies is not available.

Different explanations can be suggested for the positively priced factors found in the study. The size and BM factors might be related to the firms' default risk as the firms with high probability of default risk have high book value and are smaller in size (He & Ng, 1994; Chen & Lee, 2013). These factors can also be linked to the financial performance of the firms as small firms with high book value report lesser profits on their book value (Fama & French, 1995). Though it is possible to find rational explanations for the pricing effects captured by size and BM factors for Pakistani stocks, but the same seems difficult for the momentum premiums. The winning stocks from Pakistani market have high BM implying their poor financial performance which does not justify their consistently higher returns. The strong role of beta which the study reinforces has resulted as the factor returns for size, BM and momentum are all negatively correlated with beta and hence these factors do not capture the impact of beta. This might be indicative of some missing pricing factors with a strong positive correlation with beta. Understanding whether the size and BM effects in the cross-sectional returns of Pakistani stocks are related to any of the risk factors, whether the momentum effect is merely a result of irrational investor behavior and if there are some missing factors which can capture the impact of beta require further investigations and thus opens areas for future research.

The findings discussed above have important implication. Despite of its empirical failure (based on the samples in developed markets and some emerging markets), CAPM is still the most widely used model in applications, such as evaluating stocks' and portfolios' performance and calculating the cost of capital all over the world. The significant role of beta reported for Pakistani stocks' returns justifies the use of CAPM in these decision making areas for an emerging market like Pakistan.

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