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Investor Behaviour: Does Tax Avoidance and Liquidity Preference Culture Drive Equity Prices in Pakistan?

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Abstract

Research on investor behavior in Pakistan shows mixed results. One of the main reasons is that most emerging countries are plagued by market distortions and pricing incongruities. In Pakistan, studies have examined different asset pricing models without observing any acceptable explanations for anomalies. This study tries to fill this gap by studying investor behavior in Pakistan. The data sample is taken from the PSX (Pakistan Stock Exchange) 100 Index and we constructed eighteen portfolios to empirically analyze investor behavior evidenced through surplus returns of these portfolios in this market. The findings indicate that investor behaviour digresses from that observed by Fama and French (2015), and we do not observe strong support for their contentions. In our study F&F 5 model explains distribution of average excess returns only within selective portfolios; small weak-profitability stocks, big neutral-profitability stocks and big conservative-investment stocks. While risk and size factors drive asset prices, value and profitability premium are less important. This could stem from a tax evasion culture and the need to avoid tax payments in emerging countries. The preference for liquidity and strong cash flow-investment sensitivity is apparent in the importance of investment premium factor. Here larger investments would indicate cash-rich companies and influence investor decisions alike. The weak results of portfolio intercepts suggest there could be some omitted variables not considered in the F&F 5 model. Therefore, we recommend that in emerging countries, asset pricing models need to incorporate aspects

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of investor behaviour and culture to realistically capture market dynamics. It would enable more accurate forecasting, reduce investor asymmetry, and mispricing by creditors and capital markets. This is one of the few studies to examine and explain investor behavior within the context of its own specific culture and environment. The study attempts to explain the anomalies through investor behavior characteristics; and the first to suggest that tax avoidance culture and cash preferences may drive investor preferences and equity prices in these markets. It highlights the importance of investment considerations, and a lower importance of value and profitability in these equity markets stemming from cultural and behavioural perspectives.

Keywords: asset pricing, cash preferences, five factor model, investment premium, market premium, Pakistan Stock Exchange, profitability premium, size premium, tax evasion, value premium, liquidity, cash preference

Introduction

Mullins ([1982](#)) suggests that theory is not able to capture the actual conduct of asset prices in the real world as there are diverse and inconsistent patterns that may not be explicated through asset pricing models. The varying impacts of greedy trading, informational inadequacies, frights, fizzes, and absence of transparency, make investors' preferences fixed on certain stocks traded in the market (Frankel & Li, [2004](#)). It is these elements prevalent within the markets that confound asset valuation strategies and make asset-pricing theory deficient. The asset valuing behavior of stocks in emerging markets is even more unpredictable and unexplainable.

In the context of Pakistan, research has been conducted on asset valuation models. While the three and four factor models have been largely examined, research into the validity of the F&F 5 characteristics in this region is largely unexplained. Further, results of current studies are mixed and there appears to be a disagreement on the factors that impact equity pricing and contribute to surplus returns in Pakistan.

We examine the five factors proposed by Fama and French (2015), where the authors contentment is expected to drive equity prices and try to explain any differences or anomalies that may be observed in this market. We derive a sample of Pakistan Stock Exchange (PSX) 100 index listed firms and compile month-wise stock returns for financial and other firms for the four-year period from 2011-14. Our results show that the F&F 5 is only able to capture performance of selective asset portfolios, such as; those comprising small weak-profitability stocks, big neutral-profitability stocks and big conservative-investment stocks on the Pakistan Stock Exchange. Further, we find that investment is an important component in the pricing of assets in Pakistan, besides the size and market risk elements. Conversely, value and profitability factors are less important in equity pricing.

The study concludes that other factors may be the driving force in equity pricing, including motivation for tax evasion in relation to income and capital gains, and preferences for cash and liquidity. Tax avoidance strategies would result in focus on lower earnings and therefore lower importance of profitability. However, the objectives to avoid capital gains in taxes may cause reduced interest in value factors (and differences in asset values). In face of strong cash flow-investment sensitivities in the market, an investment heavy firm would provide signals about firm's cash base and impact equity prices. We also suggest that in our markets the F&F 5 model may not be perfect and may suffer from some omitted variable bias, relating to its specific environment and culture.

The research makes several contributions to the literature. Firstly, we extend research on asset pricing models to suggest that all the F&F5 factors may not be applicable in emerging countries and need to be modified. Secondly, we contribute to the behavioral finance literature to suggest that behavioral aspects of tax evasion and other cultural aspects need to be incorporated into asset pricing models, especially in emerging markets. Lastly, our findings provide new insights on the strong perceptions of investment-cash flow sensitivities existing in these markets. Investments provide signals of the cash strength of those firms that are valued by investors and therefore are important in pricing of equities.

The following section presents literature review, trailed by a dilation on the research objectives and hypotheses development. Subsequently, in the next few sections we delineate on the research methodology and data, results and findings with discussion of results at the end.

2. Literature Review

Over the years there has been criticism of CAPM (Sharpe, 1964) and researchers have questioned the validity of this model to suggest that other factors were important in equity pricing considerations. Basu (1977) observed that asset pricing models may suffer from omitted variable bias and therefore be incorrectly specified. They find that the P/E ratios are able to measure the stocks risk-return association and therefore suggest that its inclusion is vital to the pricing models. Banz (1981) investigated size premium effect through the association of stock return and their market value. Results indicate higher returns are exhibited by smaller firms in response to higher level of risk when compared to larger firms. They conclude this important size effect has been omitted from the CAPM. Similarly, Bhandari (1988) illustrated that leverage provides better predictability of expected returns than CAPM and suggests this as another factor to be considered in asset pricing. Thus, there is consensus that market systematic risk alone does not of itself completely describe all the variations in future stock returns.

To overcome these deficiencies, the F&F 3-factor model incorporates three additional factors: investors' concern with size, value and market risk premium that would be expected to impact abnormal returns on portfolios. The size premium (SMB) is taken as stock return variations on small and large stock portfolios based on market capitalization. F&F 3 suggests that stocks of smaller firms achieve higher returns due to being risky. The stock return variations amongst high and low book-market portfolios are taken as value and growth stocks, and encapsulate value premium (HML). High book-to-market ratio signals distress and relates to weak firms that have low earnings and exhibit positive HML slopes. While firms that exhibit larger earnings are expected to have low book-market ratio and consequently show HML slopes that are negative. CAPM captures market risk premium.

Carhart ([1997](#)) introduced another factor in his asset valuation model and incorporates momentum as an additional component. The momentum element captures the effect of winner stocks and loser stocks to suggest that stocks that perform well will do the same in the future and loser stocks would not do well in the future. The winner-loser syndrome reflects investor attitude such that they would continue to buy winner stocks in future and refrain from buying loser stocks.

Fama and French ([2015](#)) expanded on their three factors to add two additional factors; investment and profitability in their asset valuation model. The evidence supports an association between the book-market ratios and returns from equity. The authors contend that profitability and investments impact earnings and the book-market ratio, therefore, they should also affect asset prices. Chiah et al. ([2016](#)) suggested that the F&F 3-model has weaker predictive power in the Australian equity markets than the five-factor model, and the latter is able to capture the stock return anomalies in this equity market

Researchers in the Asian markets have also shown an interest in the Fama and French ([1993](#)) asset pricing model. Lin ([2017](#)) examined a sample of firms over the period from 1997 to 2015 and finds that F&F5 is more efficient than the F&F3 in the stock markets in China. While investment is less effective in capturing the excess equity returns, the value and profitability are of importance here. On the other hand, Kubota and Takehara ([2018](#)) investigated the impacts of the F&F5 in the Japanese equity market and the authors indicate that the F&F5 is not an adequate model of equity pricing in this market

In Pakistan, numerous studies (Mirza & Shahid, [2008](#); Ameer & Jamil, [2013](#); Sultana et al. [2014](#)) have investigated the impacts of F&F3, CAPM and Carhart models, with varying results. Mirza and Shahid ([2008](#)) use F&F 3 approach to understand stock return trends of firms listed on the Pakistan PSE market considering a five year data period set on daily returns, they find that size and value premia effect stock returns on the PSE and they observe a strong correlation. Sultana et al. ([2014](#)) conducted a comparative analysis between CAPM and F&F 3 factor and find that F&F 3 model is more efficient

in explaining returns in Pakistani equity market. In the same year another study conducted by Shah et al. (2014) compared CAPM, traditional F&F 3 and the modified Fama and French model. The study uses daily, weekly and monthly data sets and the authors observe that data on daily returns has greater explanatory power using both CAPM and F& F models. Rehman (2011) examined the effects of ICAPM on the PSE listed stocks and they suggest that dividend yield and risk-free rates should be taken into consideration in evaluating the investment return premium. They advocate against CAPM and suggest that the ICAPM is more efficient in capturing stock return behavior enabling efficient investment decisions. However, research on the applicability of F&F5 model is largely unexplored in Pakistan.

2.1. Research Objectives and Hypotheses Development

We test the primary hypothesis that the Fama and French (2015) five factor model is an efficient asset pricing model in Pakistan and is able to explain the asset portfolios on the capital markets. We hypothesize that size premium, value premium, profitability premium and investment premium, besides market risk elements, impact asset portfolios on the capital markets and predict that the slope coefficients of market risk, size, value, profitability and investment surpluses are significant. Further we hypothesize in null form that the intercepts of the regression equations are: $H01: \alpha = 0$, which indicates robustness of the portfolios.

3. Data and Methodology

Fama and French make a strong case for the fact that investment and profitability considerations have a strong impact on the prices of assets, and they suggest the importance of examining the market-to-book ratios of firms. We apply the F&F5 model in the study to investigate whether the asset pricing model is applicable in Pakistan; whether the markets are efficient in pricing the assets; and whether the particular asset characteristics are applicable in Pakistan. Therefore, we incorporate the two additional variables of the five factor models: investment premium and profitability premium factors. Whereas, studies on effectiveness of the F&F5 in equity markets in Pakistan are largely unexplored.

3.1. Formulation of the F&F5 Model

The F&F three factor model incorporates size, value and market risk as important characteristics of asset valuation models and studies indicate that this model captures stock return cross-sectional dispersion. Further, F&F5 (2015 a) introduce a model comprising five factors and expanding on their earlier model to further include investment and profitability in their asset valuation model. The theoretical basis of the F&F5 is in the Gordon Growth framework that contends current equity prices on the market are equivalent to the expected future dividends, discounted back to its current value, and is depicted as:

$$MV_t = \sum_{\tau=1}^{\infty} E(d_{t+\tau}) / (1+r)^{\tau} \quad (i)$$

Where MV_t denotes market value of the asset, $E(d_{t+\tau})$ depicts expected future dividends per share in the time period $(t + \tau)$ and r represents cost of equity. The above equation implies that at given period of time (t) , taking two stocks with same expected dividend stream but diverse prices, the stock with lower price will exhibit greater return and greater dividend risk.

Although, the F&F3 model adequately explains the structure of stock risk and return but the theoretical context of SMB and HML factors is not provided in the model. However, the underlying associations between expected return, book-to-market (B/M) ratio, profitability and investment may be derived through equation (i). Suppose X_{it} and BV_{it} represent net income and book value respectively of a firm at a given period of time (t) and the clean surplus condition also holds.

$$\Delta BV_{t+1} = BV_{i,t+1} - BV_{i,t} = X_{i,t} - d_{i,t} \quad (ii)$$

Then adding equation (i) and (ii), we get equation (iii) which depicts that book to market ratio of firm (i) is a function of profitability and investment. Further, the asset growth and profitability of a firm (i) is related to mean stock return.

$$MV_{i,t} / BV_{i,t} = \sum_{\tau=1}^{\infty} (X_{i,t+\tau} - \Delta BV_{i,t+\tau}) / (1+r)^{\tau} \quad (iii)$$

$BV_{i,t}$

In five-factor model operating profitability (OP) is taken as total revenue less: cost of sales, administrative and general expenses and finance expenses, scaled by the ending net book value (BV) of equity. Further, investment (INV) captures growth in assets and is taken as change in start of the year and end of the year value of the assets, divided by previous end of the year value of assets. Furthermore, six benchmark OP-size and six INV-size portfolios are used to compute RMW: which stands for Robust Minus Weak portfolios (RMW) profitability factor and conservative minus aggressive (CMA) investment factor. Incorporating these factors additionally to the conventional F&F3 model gives us F&F5 model which is shown in equation (4) below and has been defined in the earlier section:

$$r_{p,t} - r_{f,t} = \alpha p + \beta p^M MKT_t + \beta p^{Size} SMB_t + \beta p^{BM} HML_t + \beta p^{OP} RMW_t + \beta p^{INV} CMA_t + \varepsilon_{p,t} \quad (iv)$$

In this study we present empirical evidence of the F&F5 model for the case of Pakistan Stock Exchange (PSX), since recent evidence shows that the F&F5 model has higher explanatory power over F&F 3 in explaining fluctuations in equity returns. The extant literature consists mainly of studies on the subject based on developed equity markets like the US, Japan, Australia and China and are less researched in Pakistan.

3.2. Data and Portfolio Construction Method

The sample for our study comprises of 100 largest firms listed on Pakistan Stock Exchange (PSX) which are part of PSE-100 index (the largest stock index in PSX). The source of financial statement and security prices are derived from the Pakistan Stock Exchange official data website. The period of the study extends from January 2011 to December 2014 and we use closing prices to compute monthly stock returns and monthly portfolio factor returns.

The monthly returns on factor portfolios are constructed in the manner of Fama and French ([1993](#), [2015](#)) with few modifications to reflect the true state of PSX. The market risk premium constitutes PSE-100 index returns in excess of 3-month treasury bill yield. The remaining elements in the model are computed using portfolios double sorted, based on size and other factors (B/M, OP and INV).

At the end of December each year, firms were sorted according to their size (MV). Further, the firms were also ranked according to their B/M and 30th and 70th percentile of PSE-100 index firms was computed as data breakpoints. Six value-weighted portfolios were constructed using median MV and 30th and 70th percentile of B/M (the firms were allocated in to six size- B/M groups). Furthermore, the factors Market Risk, SMB and HML were computed applying the similar method to Fama and French (1993). The RMW and CMA risk factors are computed in the similar fashion with each devised to be size-neutral.

Moreover, at the end each year in December, firms listed on PSE-100 index were sequentially organized based on characteristics of size and B/M, resulting in six equally-weighted portfolios. Similarly, six more portfolios were constructed for size-OP and size-INV portfolios each. Returns from these 18 portfolios were used to describe the results of tests explained in the next section. Details of abbreviations of terminologies used in the portfolio construction are presented in Appendix A, and detailed description of portfolio construction is provided in Appendix B.

3.3. Measurement of Variables

The predicted variable of this research is a surplus return on eighteen portfolios constructed based on the size, book to market ratio, operating profit and investment, and calculated using regression technique. The excess portfolio returns rationalize the decision making to invest in risk bearing securities instead of risk-free securities. The weighted average returns of individual stocks in a portfolio comprise the portfolio returns and are arrived by using the formula: $= \sum_{i=1}^N W_i R_{it}$; and $R_{it} = LN \frac{P_t - P_{t-1}}{P_{t-1}}$. Here R_{pt} represents portfolio return, W_i is percentage of the individual stock among the portfolio and R_{it} is the individual stock return which is calculated using the closing prices of discrete stocks on a respective day (P_t) in relation to the ending price on the prior day (P_{t-1}). These average daily returns constitute monthly returns in order to avoid data breaks.

Similarly, returns of market portfolio are calculated as: $R_{mt} = \frac{PSE_t - PSE_{(t-1)}}{PSE_t}$ where PSE_t and $PSE_{(t-1)}$ represent the closing PSE

(100) index prices on a particular day and its one-year lag, which are transformed into monthly returns using average daily returns. The resultant returns enable us to calculate market risk premium (MRP) and excess return on portfolio.

Independent variables considered in the study are premiums related to market risk (commonly known as beta), size, profitability, value, and investment. The risk-free rate is deducted from market risk premium to compute the surplus an investor earns by investment in the market portfolio instead of in risk free securities. SMB captures the impact of size of a company (small versus big) on surplus portfolio return. Similarly, HML which stands for high minus low B/M ratio and captures value risk surplus achieved by companies. RMW (profitability premium) proxies the impact of robust or weak profitability on surplus portfolio returns, while CMA (investment premium) measures the impact of the investment style of a company (aggressive or conservative) on the surplus portfolio returns. These have been delineated under the section on Research Objectives and Hypotheses Development.

3.4. Analysis and Findings

Initially we performed quintile analysis to examine trends of surplus returns on the constructed portfolios displayed in Table 1.

The table presents the average surplus returns earned on investment in portfolios constructed on the basis of Size-B/M, Size-OP and Size-Inv using 2x3 sorts approach based on KSE 100 index 30th and 70th quantile as a breakpoint. These excess returns are calculated with respect to risk free securities (3-months treasury bonds taken as risk free security) during 2011-14 at KSE index Pakistan

Table 1 provides statistics on surplus returns earned by investors investing in the portfolios rather than risk free securities, denoted by R_f (3-month treasury bills). Average return on 3-months treasury bills was 0.108% during 2011-14. We constructed 2x3 sorts portfolios, based on a combination of size of the company with book-market ratio, profitability and investment approach (See Appendices A & B). In Panel A we present average surplus earned on Size-B/M portfolios. It shows highest average surplus returns on

having low book-market ratio and small in Size and lowest average surplus returns on High B/M ratio companies. Among Big companies, conversely, highest abnormal returns were earned by firms achieving High B/M ratios while bigger firms showing Low and Medium B/M ratios earned almost half average excess returns as compared to High B/M ratio companies.

Table 1
Average Surplus Returns in Portfolio

	High	Medium	Low
Panel A: Size-B/M			
Portfolios			
Small	0.029	0.035	0.055
Big	0.053	0.016	0.023
Panel B: Size-OP			
Portfolios			
Small	0.034	0.040	0.043
Big	0.014	0.046	0.037
Panel C: Size-Inv			
Portfolios			
Small	0.037	0.042	0.038
Big	0.017	0.035	0.044

Panel B of the Table indicates normal excess returns on Size-OP portfolios. Highest average excess returns were earned by small-weak OP companies, whereas small-robust OP companies earned the lowest average excess returns. However, the difference was quite negligible. Among the Big Size companies Weak and Normal OP companies earned more than companies with Robust OP.

Panel C shows excess returns on Size-Inv portfolios and depicts highest excess returns for the companies small in Size and neutral in Inv style. Moreover, average excess returns for Aggressive as well as Conservatives were almost the same among small size companies. However, Big companies with Aggressive Inv style earned lowest excess returns, whereas, Conservative companies earned the highest.

3.5. Descriptive Statistics

Table 2 presents the statistics of portfolios formed employing Size-B/M ratio. The greatest average yield is shown by SL portfolio followed by BH portfolio with over 5% return per month during 2011-14. All the portfolios show positive average returns every month. Considering the investment premium on the returns, Small companies show higher average returns with an average of 3.97% while the Neutral investment companies earn the higher average monthly return among its category with 4.27% monthly average return. Average PSE 100 index return p.m. during the span of 2011-14 was 2.2%. Average PSE 100 index return p.m. during the span of 2011-14 was 2.2%.

Table 3 presents the correlations between the PSE (100) monthly yields of the eighteen constructed portfolios. All portfolios based on size, B/M ratio, operating profitability and investment show positive relationship with each other except SC portfolio which moves in opposite direction in response to a change in BC and BN portfolios. Other portfolios show positive correlation between themselves.

Correlations between the premium factor returns are depicted in Table 4. Highest positive correlation is depicted by size premium and profitability premium. Market risk premium does not show any strong correlation with other factor returns. Further we observe an inverse correlation amongst size and value risk premia at -0.80.

Table 2

Descriptive Statistics of Portfolio Daily Returns based on Three Factors: Size-B/M, Size-OP and Size-Inv For PSE 100 Index Companies in The Sample

Variables	N	Mean	Std. Dev.	Min	Max
SH	48	0.029653	0.0628378	-0.1159	0.154033
SM	48	0.035715	0.0552297	-0.05102	0.204683
SL	48	0.0557	0.0726907	-0.07048	0.416569
BH	48	0.054018	0.2042984	-0.07455	1.2479
BM	48	0.017113	0.060104	-0.08321	0.219609
BL	48	0.023997	0.0415684	-0.06172	0.101468
SR	48	0.034855	0.0394135	-0.06257	0.114598

Variables	N	Mean	Std. Dev.	Min	Max
SN	48	0.041024	0.0587469	-0.06261	0.189692
SW	48	0.043766	0.0905956	-0.08208	0.485592
BR	48	0.014855	0.0499319	-0.08105	0.195232
BN	48	0.046508	0.2277274	-0.08745	1.531044
BW	48	0.038098	0.0942815	-0.08859	0.540114
SA	48	0.037746	0.0709912	-0.0729	0.355027
Sneutral	48	0.042786	0.061996	-0.0754	0.257874
SC	48	0.038576	0.0530824	-0.0467	0.165585
BA	48	0.018085	0.0488869	-0.08284	0.156612
Bneutral	48	0.03582	0.0814745	-0.07008	0.475981
BC	48	0.044985	0.2329789	-0.09795	1.538302
SMBBM	48	0.008647	0.0628398	-0.26555	0.131274
SMBOP	48	0.006728	0.0769244	-0.40446	0.131499
SMBInv	48	0.006739	0.0825048	-0.46305	0.127049
SMB	48	0.007371	0.0733178	-0.37769	0.129941
HML	48	0.001987	0.0864641	-0.11449	0.41344
RMW	48	-0.01608	0.0639986	-0.30236	0.084907
CMA	48	0.013865	0.0852924	-0.07609	0.545403
Rm	48	0.021994	0.0449295	-0.10937	0.131805
Rf	48	0.001088	0.0001575	0.000888	0.001369
RmRf	48	0.020906	0.0450005	-0.11072	0.13091
SMBBM	48	0.008647	0.06284	-0.26555	0.131274
SMBOP	48	0.006728	0.076924	-0.40446	0.131499
SMBInv	48	0.006739	0.082505	-0.46305	0.127049
SMB	48	0.007371	0.073318	-0.37769	0.129941
HML	48	0.001987	0.086464	-0.11449	0.41344
RMW	48	-0.01608	0.063999	-0.30236	0.084907
CMA	48	0.013865	0.085292	-0.07609	0.545403

Definition of abbreviations are provided under Appendix B.



Table 3

Correlation between Portfolios Constructed based on Size-B/M ratio, Size-Op and Size-Inv

	SH	SM	SL	BH	BM	BL	SR	SN	SW	BR	BN	BW	SA	Sneutral	SC	BA	Bneutral	BC
SH	1																	
SM	0.49	1.00																
SL	0.22	0.31	1.00															
BH	0.21	0.17	0.72	1.00														
BM	0.61	0.41	0.20	0.32	1.00													
BL	0.62	0.36	0.15	0.15	0.68	1.00												
SR	0.68	0.55	0.47	0.22	0.55	0.54	1.00											
SN	0.80	0.57	0.21	0.08	0.55	0.47	0.54	1.00										
SW	0.36	0.59	0.81	0.74	0.26	0.24	0.40	0.20	1.00									
BR	0.65	0.45	0.20	0.31	0.94	0.73	0.57	0.56	0.31	1.00								
BN	0.12	0.20	0.75	0.92	0.26	0.16	0.19	0.04	0.78	0.24	1.00							
BW	0.48	0.20	0.37	0.68	0.56	0.41	0.39	0.32	0.38	0.53	0.38	1.00						
SA	0.57	0.50	0.75	0.69	0.52	0.42	0.64	0.52	0.75	0.53	0.75	0.41	1.00					
Sneutral	0.57	0.79	0.30	0.13	0.46	0.40	0.54	0.63	0.47	0.50	0.09	0.29	0.38	1.00				
SC	0.61	0.42	0.33	0.07	0.16	0.30	0.49	0.47	0.36	0.22	-0.03	0.30	0.22	0.30	1.00			
BA	0.62	0.41	0.30	0.48	0.86	0.67	0.50	0.55	0.42	0.86	0.44	0.56	0.62	0.44	0.19	1.00		
Bneutral	0.51	0.20	0.34	0.61	0.59	0.47	0.37	0.34	0.35	0.55	0.34	0.93	0.39	0.27	0.35	0.52	1.00	
BC	0.13	0.24	0.74	0.90	0.28	0.18	0.22	0.06	0.78	0.28	0.98	0.38	0.77	0.13	-0.06	0.44	0.29	1.00

Table 4*Correlations between the Factor Returns*

	<i>SMB(BM)</i>	<i>SMB(OP)</i>	<i>SMB(Inv)</i>	<i>SMB</i>	<i>HML</i>	<i>RMW</i>	<i>CMA</i>	<i>Rm</i>	<i>Rf</i>	<i>Rm-Rf</i>
<i>SMB(BM)</i>	1									
<i>SMB(OP)</i>	0.970698	1								
<i>SMB(Inv)</i>	0.945876	0.985855	1							
<i>SMB</i>	0.979978	0.996851	0.990118	1						
<i>HML</i>	-0.77575	-0.82292	-0.79845	-0.809	1					
<i>RMW</i>	0.575002	0.662015	0.630828	0.6324	-0.77	1				
<i>CMA</i>	-0.58455	-0.73153	-0.76991	-0.712	0.67	-0.72	1			
<i>Rm</i>	0.214329	0.189697	0.159609	0.1874	-0.028	0.1257	-0.091	1		
<i>Rf</i>	-0.3571	-0.28773	-0.2607	-0.3	0.1124	-0.016	0.1061	-0.44925	1	
<i>Rm-Rf</i>	0.21524	0.190405	0.16027	0.1882	-0.029	0.1256	-0.091	0.999995	-0.452	1

4. Discussion of Results

The findings for the main empirical analyses are presented shown in Table 5. In the models, $R_{it} - R_{ft}$ represents surplus yields on the portfolios and is taken as the predicted variable in the regression models. The regressors are: SMB, HML, RMW, CMA and RPM in the eighteen models. We observe the intercepts for SW (Model 9), BN (Model 11) and BC (Model 18) models are insignificant at a 5% level of significance, indicating that in these portfolios the F&F5 model explains variations in the surplus yields. However, in other models the intercepts are not equivalent to the zero benchmark, which suggests that these models are unable to explicate the fluctuations in surplus returns in these instances and so we reject the null hypothesis. However, the slope coefficients for the regressors are largely statistically significant, leading to the conclusion that the risk, size, and investment contribute to the average excess return premium of portfolios in Pakistan. While value and profitability premiums are of lesser importance to the investment decisions.

Therefore, we find that a combination of five factors has an impact on returns and the value of R^2 indicates that the models are robust in their predictions. Models of the BH, SW, BN and BC portfolios show highest R^2 which is around 0.90, while BL, SR and SN portfolios are the weaker models with R^2 ranging from 0.20 to 0.31. The other portfolios: BA, BR, BM, SC, SA and SL, have the lowest R^2 of around 0.50.

Size premium (SMB) are statistically significant across 14 of the eighteen portfolios, however, the coefficient shows a positive association the small size (S) portfolio and an inverse relationship for big (B) portfolios. This lends support for the F&F findings that smaller cap firms behave better in the equities markets. Further, 12 of the portfolios display significant market risk premium which provides support for the CAPM model to show that higher risk results in higher abnormal stock returns.

Of the three other factors, value (HML) premium is significant in 6 out of the 18 total portfolios and shows a positive impact on the dependent variable, indicating that higher B/M ratios result in higher returns in keeping with theory that higher distressed firms reflect higher level of excess returns. The profitability premium is

significant across five portfolios but shows a negative relationship indicating that higher earnings and results in a reduction in surplus returns and thus lower equity prices. The negative relationship and lower importance for profitability factors lend support to the notion that tax evasion and cash preferences may be a dominating factor in these markets. There is a plethora of literature in support of tax evasion and tax avoidance practices in Pakistan (Khan & Ahmed, [2014](#); Rasli et al., [2012](#)) which many consider as contributing to an underground economy in the country (Iqbal et al., [1998](#); Sam, [2010](#)).

Overall investment premium (CMA) shows more robust results, with significant coefficients across 10 portfolios. Of these over all of majority of the Big portfolios (8) reflect significant impacts of investment premium. Most of the significant results show a negative relationship in the conservative-minus-aggressive investment premium. This indicates that more conservative investments show lower surplus returns while more aggressive investments result in higher equity prices. Aggressive investments send signal of the availability of cash flow and healthier firms and therefore are lucrative to investors. This finds support in the results of the size premiums on equity pricing. The negative impact on excess returns of SMB, shows that smaller firms exhibit lower equity prices. Smaller firms would have more conservative investment programs due to fewer resources, while bigger firms would invest more aggressively. Memon et al., ([2017](#)) found a significant positive association amongst investment and cash flow within firms with higher investment opportunities and observes that these firms depend on internal source of cash flows for their investments. Riaz et al. ([2016](#)) also found strong positive investment-cash flow sensitivity, though they attribute this to capital market imperfections and financially constrained firms. While Kashif et al. ([2017](#)) also confirmed a significant correlation amongst cash flows and investments in scenarios with and without capital market imperfections.

The empirical analysis of the F&F5 model applied to the PSE 100 Index firms in Pakistan shows strong predicting power in 40% of the portfolios returns with R^2 around 0.90, 15% portfolios show a weaker R^2 of 0.25 and the remaining portfolios exhibit R^2 of around 0.50. The slope coefficients are other than zero hence rejecting the



Table 5

$$F\&F5 \text{ Model } R_{it} - RF_t = a_i + b_i(RM_t - RF_t) + s_iSMB_t + h_iHML_t + r_iRMW_t + c_iCMA_t + \hat{\epsilon}_{it}$$

Variables	1	2	3	4	5	6	7	8	9
	SH	SM	SL	BH	BM	BL	SR	SN	SW
SMB	0.548*** (0.173)	0.447** (0.178)	0.0546 (0.199)	-0.884*** (0.167)	-0.580*** (0.180)	-0.391** (0.150)	0.235 (0.150)	0.449** (0.178)	0.311 (0.187)
HML	0.853*** (0.161)	0.218 (0.165)	-0.144 (0.185)	0.863*** (0.155)	0.200 (0.168)	-0.140 (0.140)	0.313** (0.139)	0.625*** (0.166)	0.0875 (0.174)
RMW	0.140 (0.181)	-0.232 (0.186)	-0.413 (0.208)	-0.641*** (0.175)	0.113 (0.189)	-0.0873 (0.157)	0.178 (0.157)	0.148 (0.187)	-0.678*** (0.196)
CMA	-0.180 (0.125)	0.107 (0.129)	0.523*** (0.144)	0.518*** (0.121)	-0.429*** (0.131)	-0.184 (0.108)	0.0545 (0.108)	-0.151 (0.129)	0.579*** (0.136)
Rm-Rf	0.403** (0.153)	0.506*** (0.157)	0.194 (0.175)	0.166 (0.147)	0.475*** (0.159)	0.375*** (0.132)	0.112 (0.132)	0.472*** (0.157)	0.529*** (0.165)
Constant	0.0202** (0.00768)	0.0162** (0.00789)	0.0376*** (0.00882)	0.0379*** (0.00740)	0.0188** (0.00801)	0.0205*** (0.00665)	0.0322*** (0.00664)	0.0311*** (0.00792)	0.0113 (0.00832)
Obs	48	48	48	48	48	48	48	48	48
R-squared	0.555	0.393	0.562	0.961	0.471	0.238	0.154	0.459	0.749

Standard errors are in parentheses. ***p<0.01, **p<0.05, Rit-RFt is the dependant variable and represents excess return on portfolio; Rm-Rf is the market risk premium on the market portfolio; while SMB, HML, RMW and CMA are described in Appendix B.

Table 5*F&F5 Model (continued)*

$$R_{it} - RF_t = a_i + b_i(RM_t - RF_t) + s_iSMB_t + h_iHML_t + r_iRMW_t + c_iCMA_t + \hat{\epsilon}_{it}$$

	10	11	12	13	(14)	(15)	(16)	(17)	(18)
Variables	BR	BN	BW	SA	Sneutral	SC	BA	Bneutral	BC
SMB	-0.388** (0.152)	-1.123*** (0.282)	-0.463** (0.192)	0.0368 (0.206)	0.436** (0.213)	0.687*** (0.165)	-0.404*** (0.139)	-0.508** (0.188)	-1.054*** (0.295)
HML	0.222 (0.142)	0.405 (0.262)	0.448** (0.178)	0.458** (0.192)	0.279 (0.198)	0.263 (0.153)	0.243 (0.130)	0.275 (0.176)	0.438 (0.275)
RMW	0.164 (0.160)	0.339 (0.295)	-0.980*** (0.201)	0.206 (0.216)	-0.339 (0.223)	-0.309 (0.173)	0.0729 (0.146)	-0.868*** (0.198)	0.588 (0.309)
CMA	-0.286** (0.110)	1.641*** (0.204)	-0.810*** (0.139)	0.287 (0.149)	-0.102 (0.154)	0.140 (0.119)	-0.286*** (0.101)	-0.767*** (0.137)	1.861*** (0.214)
Rm-Rf	0.441*** (0.134)	0.618** (0.248)	0.0241 (0.169)	0.463** (0.182)	0.435** (0.187)	0.225 (0.145)	0.386*** (0.123)	0.231 (0.166)	0.623** (0.260)
Constant	0.0147** (0.00676)	0.0237 (0.0125)	0.0356*** (0.00851)	0.0262*** (0.00916)	0.0259*** (0.00944)	0.0214*** (0.00732)	0.0177*** (0.00619)	0.0309*** (0.00837)	0.0225 (0.0131)
Obs	48	48	48	48	48	48	48	48	48
R-squared	0.454	0.910	0.757	0.504	0.310	0.434	0.522	0.686	0.906

Standard errors are in parentheses. ***p<0.01, **p<0.05, Rit-RFt is the dependant variable and represents excess return on portfolio; Rm-Rf is the market risk premium on the market portfolio; while SMB, HML, RMW and CMA are described in Appendix B.

null hypothesis to show that size, market risk, investment, and (to a lesser degree) value and profitability premiums are important in asset valuation model.

4.1. Alternative Tests: Comparison of F&F5 and F&F 3 Models

Additionally, we conduct tests to compare the robustness of the F&F5 and F&F3 models. We find that the F&F3 factor model efficiently incorporates size and value premia, besides the CAPM risk premium. However, it was thought that even these two additional factors did not adequately capture all the aspects impacting stock prices. Therefore, F&F5 incorporates two additional factors: profitability and investment premiums as additional elements into the F&F3 model.

In Table 6 we present tests of a comparison amongst F&F5 and F&F 3. Here the R^2 is taken as a measure to assess the efficiency of each model. We compare the R^2 of the six portfolios based on elements of Size-B/M ratio, using F&F5 factor model with F&F3 factor model.

Table 6

R²Tests of Models

R Squared		
Portfolios	F&F3	F&F5
SH	0.444	0.555
SM	0.379	0.393
SL	0.228	0.562
BH	0.875	0.961
BM	0.322	0.471
BL	0.230	0.238

In all the portfolios, the results indicate that the predictability of the model has increased due to inclusion of the two additional determinants surplus returns: profitability and investment. For each portfolio the F&F5 shows higher R^2 in comparison to the F&F 3 model.

5. Conclusion

In this study, we use a data sample comprising PSE 100 Index listed firms. The data spans a 2011 to 2014 time-period. Monthly returns

of PSE-100 firms are taken and eighteen portfolios are constructed according to the specifications of the model. The main contribution of this research is the finding that the factors: profitability and investment, form important determinants that explain average stock yields in Pakistan stock market. Previous equities valuation models for example, CAPM and F&F3 models are subject to criticism for overlooking important factors. The F&F5 model provides more in-depth analyses in asset pricing behavior. Though the model proves successful in efficient markets there is lack of empirical evidence on the implementation of five factor model in a third world country like Pakistan where the markets are not so efficient and where market forces play a significant role in determining the market behavior and stocks returns.

Our findings indicate the F&F5 framework efficiently explains average surplus returns dispersion in portfolios comprising small weak-profitability stocks, big neutral-profitability stocks and big conservative-investment stocks. A key insight of this research is that investment is an important determinant along with size and market risk factors, and therefore needs to be included in asset pricing models when assessing fluctuations in returns in the Pakistan equity market while value and profitability are of lesser importance in capturing excess stock returns in portfolios in this market. Overall the F&F5 is a stronger model as compared to F&F 3 in the Pakistan equity markets as evidenced by the R^2 differentials.

These markets respond to risk and size which are reflected in stock prices and ,to a lesser extent, to value and profitability premium. It is possible that in Pakistan, higher income may be less lucrative to cash flow where firms would rather show lower earnings in order to save taxes and enhance cash flow. The assets would also be manipulated to save on capital gains taxes. Thereby there is a strong tax avoidance culture in this environment, and market dynamics may be different here.

Investment is the one factor that appears to have significant explanatory power in each model. It would also support the earlier concept that cash flow/liquidity may be of greater importance and that higher investments appear to provide signals of higher cash flow

in these markets. This is supported by other studies regarding the investment –cash flow sensitivity in Pakistan.

In conclusion, our research finds selective support for the F&F5 model, where investment, risk and size are important determinants in asset pricing, and to a lesser extent value and profitability. We suggest that some additional factors related to the culture and atypical investor behavior in emerging countries need to be incorporated into asset pricing models. The weak intercepts also signal that there may be some variables missing leading to omitted variable bias and need to be incorporated to arrive at stronger and more effective models.

We suggest that in emerging countries, asset pricing models need to incorporate aspects of investor behaviour and culture to realistically capture market dynamics. It would enable more accurate forecasting, reduce investor asymmetry, and mispricing by creditors and capital markets. There is a limitation of availability of data in emerging countries, while weak monitoring mechanisms could result in some manipulations in these markets. Therefore, the study would be generalizable to those emerging countries that share similar characteristics as Pakistan. Future studies may focus on expanding the time frame of analysis and extending the sample of companies for portfolio construction in order to test this model.

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Appendix A

Definition of Abbreviations used in Portfolio Construction

	Abbreviations	18 Portfolio Abbreviations
SMB (Size Factor: Market Capitalization)		
Small Size Stocks	S	SMB = S-B
Big Size Stocks	B	
HML (Value Factor: (B/M) Book-Market Ratio)		
High Ratio	H	SH= Small_High
Medium Ratio	M	SM = Small_Medium
Low Ratio	L	SL = Small_Low
		BH= Big_High
		BM = Big_Medium
		BL = Big_Low
RMW (Profitability Factor:(OP) Operating Profitability)		
Robust Profits	R	SR = Small_Robust
Neutral Profits	N	SN = Small_Neutral
Weak Profits	W	SW= Small_Weak
		BR = Big_Robust
		BN = Big_Neutral
		BW= Big_Weak
CMA (Investment Factor)		
Conservative	C	SC = Small_Conservative
Neutral	neutral	Sneutral = Small_neutral
Aggressive	A	SA= Small_Aggressive
		BC = Big_Conservative
		Bneutral = Big_neutral
		BA= Big_Aggressive

Appendix B: Portfolio Construction for the F&F Five Factor Model

Portfolios based on Size, B/M Ratio, Operating Profit and Investment:

In order to measure size premium, stocks traded are categorized according to market capitalization that is computed taking individual equity prices and number of outstanding shares of each company. A further classification of the stocks on the basis of size market capitalization (B and S) are constructed with the combination of each premium: B/M ratio, operating profitability and investment resulting in a total of eighteen portfolios.

Stocks are further classified into Low (L), Medium (M) and High (H) B/M ratio. Highest and lowest 30 % companies are taken into High and low category, respectively and remaining 40 % constitutes Medium (M) B/M ratio. Book value is obtained as a product of outstanding shares and book value of each share. Moreover, six portfolios namely SL (Low B/M ratio and small market capitalization), SM, SH, BL (Low in B/M ratio and big in market capitalization), BM, BH have been constructed using three B/M ratio portfolios based on two sizes (B-big and S-small) of the companies.

Likewise, the other two proxies, operating profitability and investment, are considered with size and combinations of six portfolios are created using each proxy with size factor. Portfolios for Size-OP are then categorized as SR, SN, SW, BR, BN and BW. Parallel, six portfolios constructed for Size-Investment premium are SC, SN, SA, BC, BN and BA.

Market Premium SMB and HML Factors

Market risk premium is calculated by taking excess of index returns of PSE 100 index over the 3 months' treasury bills rates. This variant is similar to CAPM, furthermore Fama & French add other risk aspects namely SMB, HML, RMW and CMA. The following equation computes market risk premium:

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

2×3 sorts portfolios technique is used here. The equities are classified into two categories on the basis of Size, and three groups are segregated based on the book-market ratio (B/M), operating profitability (OP), and investment (Inv). Moreover, we construct the portfolios for each value, OP and Investment premia with respect to size. We use two letters to describe each portfolio. For example, in the Size category, S and B in the first letter denotes small and big sized groups. For the book-market (B/M) ratio we use letters H, N and L to denote high, neutral and low groups respectively. The OP group is represented by R N and W to signify robust, neutral and weak groups respectively, while the Investment group uses symbols of C, N and A to depict conservative, neutral and aggressive groups.

Thus, the Fama and French five factors are: a) SMB for the average yields of the small minus big portfolios; b) HML stands for the average yields of the high minus low B/M ratio portfolios; c) RMW depicts average premia on robust minus weak OP portfolios; and d) CMA stand for the conservative minus aggressive investment (Inv) portfolios. We follow the methodology and formulas prescribed by Fama and French ([2016](#)) for the computation of the variables in the portfolios.