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Liquidity, Downside Risk, and Asset Pricing:

Evidence from Pakistan's Stock Market

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Abstract

The purpose of this study is to extend the Fama &French three-factor model to a six-factor model by incorporating stock liquidity and Value at Risk (VaR), to capture the vulnerability of emerging markets such as Pakistan. The database from the Pakistan Stock Exchange, along with balance sheet analysis from the firm level provided by the State Bank of Pakistan from 2015 to 2024, was used to investigate the explanatory power of the extended model based on regression analysis. The findings demonstrate that more liquid stocks will have lower risk premiums and are therefore more attractive to investors, and firms with lower VaR will yield consistent returns. On the other hand, firms with a higher VaR will yield more returns, but with added downside risk. Hence, the model improved on the asset pricing abilities by including liquidity and VaR, making it more pertinent for risk-adjusted decisions for global investors, enhancing risk management frameworks for financial institutions, and developing regulations that augment market efficiency and regulation for policymakers. The research highlights the relationship between liquidity and downside risk in asset pricing, supporting the growing research on emerging markets, and recommends considering more macroeconomic factors, such as ESG factors, interest rates, and monetary policy, while testing the model in other emerging economies.

Keywords: Stock liquidity, Value at Risk (VaR), Asset pricing models, Fama-French models, Pakistan Stock Exchange

JEL Codes: G12, G15, C58, O16

1 Introduction

Asset pricing is a central concept of finance, suggesting the reasons why securities are valued in financial markets. It acts as a vehicle for investors to make decisions, supports risk management, and informs how financial institutions construct their portfolios. Asset pricing implies a connection between risk and return, which is important in capital allocation and decision-making associated with finance. One tenet of the capital market theory is the trade-off between risk and return; i.e., risk-seeking investors must take on additional risk to receive additional reward. In Markowitz (1952), the foundations of the tenet were laid with MPT introduced in his work with a focus on diversification in investment decisions. The main focus of MPT is to find optimal ways to measure risk and how risk affects stock returns (Chughtai, 2016).

Asset pricing theory is one of the principal components of MPT, which is concerned with identifying sources of risk and estimating the incremental expected return, otherwise referred to as "risk premiums" that investors should expect for taking on that risk. Markowitz's contribution to MPT provided a structured way to build an efficient portfolio, which permitted trade-offs between risk and return across a portfolio of different assets. The Efficient Market Hypothesis (EMH) claims that stock prices incorporate all publicly available information, which implies there is no systematic trading pattern resulting in abnormal returns. Afterward, Ross (1976) built on the CAPM idea to develop the Arbitrage Pricing Theory (APT), which argued that asset returns came from different sources besides market risk, therefore allowing for firm-specific and country-specific variables. Historically, researchers have made countless additions and extensions to add the explanatory value of asset pricing models. These models can tell us how certain characteristics of firms led to the stock prices that are used in making portfolios or through performance record-keeping techniques associated with modern financial econometrics. The FF3FM is a variation of CAPM described by Fama and French (1993), which included two additional factors to the CAPM return estimation model: size (SMB: small minus big), and value (HML: high minus low). The factors were added to explain the additional return small-cap stocks and value stocks received over large-cap or growth stocks for the sample period. The approach of incorporating additional explanatory factors for returns was further developed with the introduction of the FF5FM, which includes investment (CMA: conservative minus aggressive) and profitability (RMW: robust minus weak) factors as additional sources of return variation based on firms' capitalization patterns and profitability. However, contrary to the past U.S. returns, the Fama and French (2017) findings suggest that the significance of the study's value factor demonstrated notable non-uniformity across countries, most notably with its specification in U.S. equity markets apparently generating its significance in further research in particular countries, while demonstrating diminished or no value factor significance in other countries. These findings suggest a need for asset pricing models to be adjusted for local factors affecting the asset pricing process. In Pakistan, the FF3FM has garnered attention and been well-studied.

The FF3FM has been studied in Pakistan by several authors. Firstly, Sarwat et al. (2019) and Khan et al. (2023) have evaluated the model; while both sizes and value did explain some of the variance in returns generated by the model, they did not explain the variance in a volatile and relatively inefficient market. Researchers have subsequently improved the model by adding variables such as human capital, momentum, and liquidity. For example, Younus (2022) showed that a six-factor model provided a better explanation of the anomalies in the Pakistani market, while Haqqani and Aleem (2020) indicated that liquidity and momentum improved the predictive ability of the five-factor model. Recent research has also stressed the additional predictive ability of risk measures such as Value-at-Risk (VaR) and liquidity in asset pricing. VaR is used by financial institutions to manage the risk in their portfolio or asset as it often indicates the maximum expected loss that may occur under normal market conditions, within a stated time frame, that an organization is willing to incur. In fact, VaR gives an estimate of the amount of loss in the downside risk of an asset (Acerbi & Sarma, 2022). Bali et al. (2014) highlighted the value of VaR as a model predicting stock returns in volatile market conditions. The authors found that the greater the VaR, the higher the expected return in accordance with the risk–return expectation. Liquidity, which refers to the ease of exchanging assets without significant price impact, has long been established as a substantial factor of stock returns and market efficiency. Studies have found strong positive associations between stock market liquidity and returns, as liquid markets usually produce lower transaction costs and liquidity price impact (Faff et al., 2018).

In emerging markets (e.g., Pakistan), liquidity risk, loss of liquidity, and implications of low market depth make liquidity an even larger risk, due to the lesser capitalisation for liquidity, flipping, variability in trading volumes, and increased shocks and vulnerabilities (Thalassinos et al., 2023). Illiquid assets tend to offer a larger risk premium, especially when pressuring liquidity and generating volatility, hence experiencing more downward pressure ultimately.

Traditional models like CAPM and FF3FM will be restricted to capture this as a factor in emergent and unreliable markets, and face challenges to include downside risk and liquidity limitations, which might help explain returns associated with macroeconomic uncertainty and shifts in trust and behaviour by investors. During attempts to factor in VaR and liquidity into these models, a gap in the literature, particularly in the Pakistan context.

While some research has examined various factors, including human capital, momentum, and profitability, little research has explored the combined effect of liquidity and downside risk on enhancing asset pricing accuracy.

This research seeks to contribute to the literature and provide new insights into the evaluation of asset pricing in several ways. First, this research empirically tested the extended six-factor model (liquidity and VaR included) in Pakistan, where the traditional five-factor model (Fama & French, 2015) does not perform particularly well. Second, our study explores how liquidity and VaR interact with traditional factors as a means of providing insight into the behavior of returns in the context of a new economy and a volatile environment. Finally, the study offers operational suggestions for investors, policy-makers, and financial institutions in relation to risk-adjusted decision making, improvement of regulations, and methods of portfolio construction.

The main aim of this research is to determine if additional stock liquidity and Value-at-Risk (VaR) increase the explanatory power of the Fama–French model within the Pakistani stock market. First, this research aims to analyze the effects of stock liquidity and VaR on stock returns. Second, it looks at the relationship of liquidity and VaR in light of the three-component Fama–French model. Finally, it aims to determine if the extended model is superior to the standard three-factor model and the Fama and French four-factor model.

Based on this main direction, this research examines the following questions: Does the introduction of stock liquidity make a difference in the explanatory capacity of the model's ability to model stock returns in Pakistan? To what extent does VaR improve the explanatory power of the model? How do liquidity and VaR interact with the other Fama–French model factors in a volatile and relatively liquid capital market? Finally, does an extended model including six factors provide an improved explanation of asset returns compared to previous models? This research expands the asset pricing literature by recognizing the limitations of extant models in adequately understanding risk and return exposure dynamics in emerging markets. In synthesizing stock liquidity in the Fama-French model and the addition of VaR, the research presents a more context-specific model that is qualitatively accurate in predicting stock returns in Pakistan. The results of the study will enable more informed investment decisions by investor groups, provide financial institutions with help in building robust risk management strategies, and give policymakers critical insights into improving market stability and efficiency. Additionally, the study has broader implications for other emerging economies experiencing structural and market similarity.

2 Literature Review

The Capital Asset Pricing Model (CAPM) has historically been esteemed as a fundamental concept for understanding the risk–return trade-off in finance. Putra et al. 2023 offer a comprehensive review of the literature related to the utilization of CAPM in forecasting stock returns, demonstrating that investors can use the model to estimate expected returns for stocks the investor is interested in, subject to the risk of each stock. They establish the merit of a qualitative study of CAPM, utilizing both inductive and deductive reasoning to explore the interactions of risk and return in investment decisions. This study is able to highlight both the value of CAPM in informing investors' decisions, as well as the limitations of the model and the possibility for modifications to enhance its usefulness in reflecting market phenomena. Future research will likely be informed by engagement with behavioural finance and the macroeconomic variables that also potentially enhance the predictive nature of a CAPM-based model. It will also be prudent to consider the model's performance when applied in emerging economy contexts, since the market structure and patterns of investor behaviour could have substantive differences when comparing investor behaviour in emerging and industrialized economies. Expanding the boundaries of inquiry through more contexts might strengthen the power of the model and give more clarity into how the market reacts and how investors decide.

The aim of the research is to further develop the Fama-French three-factor model into a six-factor model through the measurement of stock liquidity and Value at Risk (VaR). This extension extends a recent adaptation in the Pakistan-specific case, including Khan et al. (2022), who added a labor-income-growth factor, the point of which is to more accurately represent the vulnerability of emerging markets such as Pakistan.

2.1 Size Effect and Stock Returns

Firm size has been common in the past literature as a correlates of stock returns, but the persistence of the size premium remains a debated issue in asset pricing. The idea for including firm size as a factor is that smaller firms in particular may face high levels of uncertainty due to limited information supply resulting in high levels of risk. Although market capitalization is often conflated to represent firm size; empirical research takes either a market capitalization classification of firm or refers to classification along a market capitalization dimension of large cap firms and small cap firms. Banz (1981) presented a challenge to the traditional CAPM by sufficiently demonstrating that small capital firms and portfolios have higher returns. This spurred the idea of the size effect. Mirza and Shahid (2008) found small cap portfolios to yield superior returns; Khan et al. (2023) found large cap portfolios to yield superior returns.In a meta-analysis of 102 studies from 1,746 estimates, Astakhov et al. (2017) found that the size premium has been inflated due to publication bias and should be estimated at an average effect of 1.72% annually instead of the typical size premium of 5%. Their findings indicate that the size effect is not uniformly determined but varies across markets, time periods, and firm types. In prior studies, Keim (1983) noticed that the size effect was greatest in January and Knez and Ready (1997) reduced the size effect by excluding the bottom 1 % smallest firms. These findings suggest that future research should investigate how market liquidity, behavioral biases, and business cycles interact with firm size in response to AGP and whether the size premium can be classified as a persistent risk factor or a conditionally persistent risk premium.

2.2 Value Effect and Stock Returns

The value effect (book-to-market ratio) has been a consistent measure of stock return performance and has been repeatedly found to be a statistically significant determinant of stocks. Rosenberg (1985) established that firms with high book-to-market ratios outperform the book-to-market mindset firms by identifying a predictable value factor. Urooj (2017) additionally demonstrated that CAPM is inadequate in capturing the value effect, thereby suggesting the need for better predictors in asset pricing. Fama and French (1992) provided pioneering evidence that the two size and value factors capture meaningful cross-sectional variation in stock returns, and this proof has been replicated globally. Their research shows that value stocks are generally underrated when compared to fundamentals, i.e., dividends and earnings, whereas growth stocks regularly underperform over the long term.

Tripathi and Aggarwal (2018) studied the Indian stock market for the period 1999-2015 and showed that a low price-to-book, price-to-earnings, or dividend yield stock was consistently outperformed compared to growth stocks, indicating a challenge to market efficiency. Their conclusions provided evidence that investors are using fundamental measures of valuation to improve returns, with opportunities for future research exploring multiple valuation measures across different markets.

2.3 Human Capital and Stock Returns

Recent literature has highlighted the increasing role of human capital in establishing firm value and stock market performance. Human capital is defined as the skills, knowledge, and experience of employees and firms that invest in staff development and training, and staff well-being tends to provide better financial performance. According to the Human Capital Investment and Reporting Council (2021), companies with human capital policies tend to be more profitable and deliver better returns. However, the capital markets do not always understand how to price human capital factors. Condić-Jurkić (2023) argued that investors undervalue human capital, whereas Fedyk and Hodson (2023) outlined the evidence showing they outperform peers with low-skill, low-capability, and/or high turnover workforces, especially Housing Depends on Human Capital to locate workers and maximize labor efficiency, employed to value all capital as well as housing stock.

Amos and Oboh (2023) investigated and found that in Nigeria, investors improved their responses when firms published investments in educational programs and/or career development, which emphasizes that communication related to human capital may positively relate to a firm's valuation. The markets are also innovating, where the Human Capital Index ETF (HAPI) has outperformed 90% of traditional peers since inception in 2022 and demonstrates investor acceptance concerning human capital's role in long-term value as a contributor (Financial Times, 2024). 2.1.4 Value at Risk (VaR) and Stock Market Returns

2.4 VaR and Stock Returns

Value at Risk (VaR) has become a crucial aspect of financial risk management, measuring the most expected loss of a portfolio in a given time period at a given confidence level. Ramlall (2018) argued the importance of VaR to assess financial stability, describing methodologies of the different approaches (like parametric models, historical simulation, and Monte Carlo simulation). While beneficial and helpful in their own way to report exposure limits, VaR is in need of complementary risk measures to optimize predictive accuracy in volatile environments. Shah and Raza (2014) inspected the Karachi Stock Exchange (KSE-100) and argued that value at risk using variance–covariance methods performed poorly given the normally-distributed returns assumption, compared to historical simulation, which performed better estimates of VaR. In their finding, Iqbal and Azher (2008) found that portfolios that had higher value at risk provided higher average returns, which is also in line with the risk–return trade-off. Iqbal and Azher found value at risk to outperform the Fama–French factors explaining average returns in Pakistan.

2.5 Liquidity and Stock Returns

Liquidity is the ability to accredit changes in the value of assets, especially liquidity risk in an equity, without significantly affecting the both price or how that reflects in the market fundamental grades (however regimes of some type to make bad stocks good and good stocks bad, which means if you ever need to liquidate an indebtedness stock holding, understood risk) factors towards stock returns (Huang & Wang, 2023). High liquidity offers lower transaction costs, better price discovery, and more investor involvement (Huang & Wang, 2023). Naik and Reddy (2021) tackled a few of the important drivers of liquidity-inflation, interest rates, and investor sentiment. But as some reviews are many notable areas of further research on liquidity impact within developing economies. Amihud and Mendelson's (1986) liquidity premium hypothesis indicated that investors expect receiving some type of return required for holding an illiquid stock, or that it does not have an impact on the price of a stock unless there is a substantial return (risk). In turn, Pástor and Stambaugh (2003) ultimately confirmed the pricing of liquidity risk within stock returns.

Many other forms of research moved forward, also covering further implications of liquidity to consider in stock returns in terms of what that suggests. Chikwira and Mohammed (2022) provided evidence that higher liquidity and lower volatility provided more indication of financial development (risk on and off), and Muzaffar and Malik (2024) showed that liquidity is directionally affected by macroeconomic uncertainty, and more importantly, in critical instances where liquidity was reduced during the liquidity hysteresis I called. Ultimately, liquidity is an experimental degree on stock returns, and also a systematic function impacting returns.

2.6 The Fama–French Models and Extensions

The Fama–French three-factor model (Fama & French, 1993) included size and value, in addition to the market factor, and was a considerable expansion on the CAPM by providing a more complete explanation of asset returns. There have been several empirical studies, like Hasan et al. (2015), that have been able to confirm whether size and value were valid risk factors in Pakistan, while Bhatti and Hanif (2010) showed that CAPM didn't suffice. Hasan et al. (2015), evaluating the Dhaka Stock Exchange (Bangladesh), also reported on the strong explanatory power of the size and value premiums in their analysis. From that point, Fama and French (2015) extended the model even further to a five-factor model by adding profitability (RMW) and investment (CMA). Further studies showed that, although the new model outperformed the CAPM, the evidence was mixed across markets.

The authors have made further extensions to the model. Khan et al. (2023) used human capital as a new fourth factor in the context of Pakistan, discovering similar explanatory relevance, which corroborated other studies focusing on human capital as an additional factor. Younus (2022) examined the six-factor model, and although his model performed better than the others at capturing anomalies, he still faced limitations that others have in the past. Haqqani and Aleem (2020) further extended the five-factor model by adding momentum and liquidity factors (where they also displayed improvement over the five-factor model) to examine their performance among ratings as they were examining Pakistan's market. Thalassinos et al. (2023) also wrote about the need for being able to have people put in additional factors, including liquidity or VaR (which would improve quality), particularly in developing countries or emerging markets that have so much inefficiency in the market.

This literature shows that even if traditional asset pricing models lay the ground for understanding return behavior, they do not typically identify important risks encountered in new markets such as Pakistan. The literature on liquidity and VaR is limited, and while the gap may seem less critical, liquidity and VaR remain important to study, especially in developing, volatile, and thinly traded markets. Thus, the gap persists, and this study seeks to fill that gap by expanding on the Fama-French framework through liquidity and VaR, and hopefully, will inform a better understanding of stock return processes in Pakistan.

3 Research Methodology

The present research follows a quantitative methodology via secondary data from the Pakistan Stock Exchange (PSX) to explore the extended Fama-French model in terms of stock liquidity and Value-at-Risk (VaR). The sample consists of 120 non-financial firms, excluding those that were deteriorated (were delisted or declared bankrupt), over the period being analyzed (2015 to 2023). The study employs time series regression analysis to explore the stock returns of firms with respect to their degree of stock liquidity and VaR. The main variables of interest include stock price, market capitalization, trading volume, and Treasury bill (T-bill) rates, which were taken from various financial data sources such as Investing.com, Business Recorder, and the Balance Sheet Analysis of the State Bank of Pakistan. E-Views and Microsoft Excel are used for data analysis.

In this study, the dependent variable is the excess portfolio return, (Rp-Rf), the independent variables include market risk, size, value, human capital, stock liquidity, and VaR. Portfolio excess returns are calculated from the average monthly returns using the closing stock prices, with the risk-free return given by the T-bill yield. The market factor (Rm-Rf) is the excess return, in the case of this study, the excess return on the KSE-100 index (Thalassinos et al., 2023).

The size factor (SMB: small minus big) represents the return difference between small and large firms, using market capitalization as a proxy for firm size. The value factor (HML: high minus low) is based on the book-to-market ratio, which is calculated as the book value of equity divided by a firm's market capitalization on trading day t (similar to, e.g., Fama & French, 1992; Rosenberg, 1985). Human capital is measured by the annual salaries and wages reported in firms' financial statements (Maiti & Balakrishnan, 2018). Stock liquidity is assessed through the turnover ratio, which is total trading volume divided by market capitalization (Chughtai, 2016). VaR is estimated using the variance–covariance method based on monthly stock returns at a 95% confidence level, assuming normally distributed returns. In this method, risk is quantified by the standard deviation of returns, with a z-score of 1.654 corresponding to the 95% threshold.

3.1 Portfolio Formation

For empirical testing of the model, 63 portfolios were formed by classifying the 120 firms (represented in the study) across various metrics, including size, value, human capital, stock liquidity, and VaR. The firms were placed into the respective high and low groups within each metric or characteristic. For example, the firms were categorized with large versus small market capitalization, high versus low book-to-market ratio, strong versus weak human capital situations, liquid versus illiquid stocks, and value at risk (VaR) by high versus low. The analysis will capture the cross-sectional variation in stock returns attributable to the aforementioned dimensions. The process for portfolio formation in this research is congruent with portfolio construction in the asset pricing literature in order to stay consistent with asset pricing research that has preceded this study (Fama & French, 1992, 1993, 2015).

3.2 Estimation method

We estimate the equations by using the OLS (ordinary least squares) estimator, which is most commonly used due to its simplicity and the best linear unbiased estimator (Wooldridge, 2016).

3.3 Testing the models

In this study, we test the validity of Fama-French models by using a time series regression approach.

3.3.1 Testing FF3FM by time series regression approach

The models tested by time series regression have been used in many previous studies (Fama & French, 1993, 2015). We estimate the FF3FM by using time series data. The FF3FM specified as:

$$R_{it+1} - R_f = \alpha_{it} + \beta_1 (R_{mt} - R_f) + \beta_2 SMB_{it} + \beta_3 \, HML_{it} + \epsilon_{it+1},$$

where R_{it+1} is the Return on asset i at time t, I is the total number of portfolios (I=63), and T is the total number of observations (T=108), R_f is the Risk free rate, R_{mt} is the Market return, SMB_{it} is the Small minus Big (size factor), HML_{it} is the High minus low (value factor), $\boldsymbol{\alpha_{it}}$ is the Intercept (alpha) for asset i, $\beta_1, \beta_{2\,,}\, \beta_3$ are the Factor loading coefficients, and ϵ_{it+1} is the error term.

If the Fama-French three-factor model is valid, then α_i should be 0. Thus, given the estimates for 63 portfolios, the following null hypothesis is tested by us:

$$H_0 = \alpha_1 = \alpha_2 = \alpha_3 = \cdots = \alpha_{63} = 0.$$

We test the above joint null hypothesis by using the OLS approach.

3.3.2 Testing Human capital based four factor model by the time series regression approach

By including the HC factor, the specification becomes:

$$R_{it+1} - R_f = \alpha_{it} + \beta_1 (R_{mt} - R_f) + \beta_2 SMB_{it} + \beta_3 \, HML_{it} + \beta_4 \, HC_{it} + \epsilon_{it+1},$$

where HC=Human Capital

β_4=Loading on the HC factor

If the Human capital-based four-factor model is valid, then α_i should be 0. Thus, given the estimates for 63 portfolios, the following null hypothesis is tested by us:

$$H_0 = \alpha_1 = \alpha_2 = \alpha_3 = \cdots = \alpha_{63} = 0.$$

We test the above joint null hypothesis by using the OLS approach

3.3.3 Testing Stock liquidity and VaR-based six-factor model by time series regression approach

After adding two additional factors, the specification becomes:

$$R_{it+1} - R_f = \alpha_{it} + \beta_1(R_{mt} - R_f) + \beta_2 SMB_{it} + \beta_3 HML_{it} + \beta_4 HC_{it} + \beta_5 SL_{it} + \beta_6 VAR_{it} + \epsilon_{it+1},$$

where

SL_{it} = Stock Liquidity factor (measured using the Turnover ratio or similar metrics)

VaR_{it}= Value at Risk factor (calculated using the variance-covariance method)

β_5 = Loading on the liquidity factor

β_6= Loading on the VaR factor

If the Stock liquidity and VaR-based six-factor model is valid, then α_i should be 0. Thus, given the estimates for 63 portfolios, the following null hypothesis is tested by us:

$$H_0 = \alpha_1 = \alpha_2 = \alpha_3 = \cdots = \alpha_{63} = 0.$$

We test the above joint null hypothesis by using the OLS approach.

4 Results and Discussion

4.1 Descriptive statistics

This table shows the descriptive analysis of all portfolios for the period of 2015-2023 with 108 observations. This table shows results for panel 1, small-sized portfolios, and panel 2, big-sized portfolios.

Table 1. Descriptive statistics

Portfolios	Mean	Standard Deviation	Kurtosis	Skewness	Minimum	Maximum
P	0.0019	0.0592	3.711	0.148	-0.167	0.1835
Panel 1: Big-sized portfolios						
B	-0.0006	0.0642	4.071	0.215	-0.2018	0.1922
B/L	0.0008	0.0653	3.561	0.133	-0.2005	0.1725
B/H	-0.002	0.0667	4.576	0.259	-0.2031	0.2119
B/L/LHC	-0.0042	0.0665	4.065	0.203	-0.2139	0.1888

B/L/HHC	0.0163	0.0696	2.917	0.002	-0.1871	0.161
B/H/LHC	-0.004	0.0725	4.411	0.26	-0.2328	0.2172
B/H/HHC	0.0049	0.0664	3.378	0.032	-0.2097	0.1731
B/L/LHC/LSL	0.0002	0.065	5.048	-0.182	-0.2503	0.2106
B/L/LHC/LSL/LVaR	0.0081	0.0735	3.332	0.205	-0.1948	0.2213
B/L/LHC/LSL/HVaR	0.0013	0.0487	4.417	0.654	-0.118	0.1835
B/L/LHC/HSL	-0.0062	0.0836	4.889	-0.091	-0.3412	0.2344
B/L/LHC/HSL/LVaR	-0.0104	0.1	4.722	-0.21	-0.414	0.2536
B/L/LHC/HSL/HVaR	0.0028	0.0636	4.407	0.227	-0.2221	0.2051
B/L/HHC/LSL	-0.003	0.0682	3.494	0.011	-0.192	0.2057
B/L/HHC/LSL/LVaR	0.0083	0.0816	3.857	-0.03	-0.2325	0.2554
B/L/HHC/LSL/HVaR	0.0008	0.0564	3.408	0.0214	-0.1639	0.1803
B/L/HHC/HSL	0.0081	0.0846	3.182	-0.041	-0.212	0.2462
B/L/HHC/HSL/LVaR	0.0163	0.1062	2.806	-0.078	-0.2466	0.2629
B/L/HHC/HSL/HVaR	0.0023	0.0653	2.928	0.007	-0.1687	0.1564
B/H/LHC/LSL	-0.006	0.0707	5.79	-0.332	-0.3145	0.1898
B/H/LHC/LSL/LVaR	-0.0113	0.095	5.015	-0.155	-0.3877	0.2646
B/H/LHC/LSL/HVaR	-0.0056	0.0589	3.409	0.041	-0.2009	0.1358
B/H/LHC/HSL	-0.0031	0.0895	4.696	0.581	-0.2433	0.3253
B/H/LHC/HSL/LVaR	0.0048	0.1107	4.377	0.645	-0.2723	0.4032
B/H/LHC/HSL/HVaR	-0.006	0.0698	3.882	0.134	-0.2103	0.2251
B/H/HHC/LSL	0.0009	0.0628	5.494	0.649	-0.1954	0.2419
B/H/HHC/LSL/LVaR	0.0049	0.0861	7.713	1.259	-0.2025	0.4218
B/H/HHC/LSL/HVaR	-0.0043	0.0476	4.028	0.2	-0.163	0.1406
B/H/HHC/HSL	-0.0023	0.0795	3.856	0.134	-0.2383	0.2503
B/H/HHC/HSL/LVaR	-0.0023	0.0938	4.694	0.529	-0.2393	0.3552
B/H/HHC/HSL/HVaR	-0.0031	0.0664	3.378	0.031	-0.2097	0.1731

<u>Panel 2: Small size portfolios</u>

Portfolios	**Mean**	**Standard Deviation**	**Kurtosis**	**Skewness**	**Minimum**	**Maximum**
S	0.0045	0.0594	3.393	0.1892	-0.1431	0.185
S/L	0.0036	0.0616	3.613	0.4132	-0.1338	0.1938
S/H	0.0053	0.0648	3.102	0.1474	-0.1647	0.1762
S/L/LHC	0.0059	0.0635	3.397	0.1884	-0.1541	0.195
S/L/HHC	0.0011	0.0702	3.369	0.4581	-0.1454	0.2195
S/H/LHC	0.0074	0.0715	3.001	0.3638	-0.1706	0.1794
S/H/HHC	0.0031	0.0686	2.933	0.0146	-0.1588	0.1994
S/L/LHC/LSL	0.0058	0.0715	3.243	0.6463	-0.1292	0.1974
S/L/LHC/LSL/LVaR	0.0007	0.1014	4.379	1.0686	-0.2053	0.355
S/L/LHC/LSL/HVaR	0.0028	0.058	4.675	0.4931	-0.1508	0.1937
S/L/LHC/HSL	0.0068	0.0871	3.164	-0.0006	-0.201	0.271
S/L/LHC/HSL/LVaR	-0.0042	0.1127	3.338	0.1127	-0.3439	0.245

S/L/LHC/HSL/HVaR	0.0017	0.0755	4.266	0.217	-0.218	0.2745
S/L/HHC/LSL	-0.0041	0.0628	2.885	0.0349	-0.1659	0.1523
S/L/HHC/LSL/LVaR	-0.0039	0.0861	3.12	0.0861	-0.1964	0.2808
S/L/HHC/LSL/HVaR	-0.0068	0.0552	4.016	0.5379	-0.1184	0.184
S/L/HHC/HSL	0.0057	0.0983	3.706	0.695	-0.1821	0.3286
S/L/HHC/HSL/LVaR	0.0018	0.1231	3.969	0.5963	-0.2726	0.4619
S/L/HHC/HSL/HVaR	0.0021	0.0787	3.423	0.3895	-0.1545	0.2734
S/H/LHC/LSL	-0.0041	0.0628	2.885	0.0349	-0.1659	0.1523
S/H/LHC/LSL/LVaR	-0.0005	0.0842	4.427	0.1566	-0.3164	0.2341
S/H/LHC/LSL/HVaR	0.0013	0.0482	3.4	0.8094	-0.0872	0.133
S/H/LHC/HSL	0.0082	0.1098	3.671	0.396	-0.2749	0.322
S/H/LHC/HSL/LVaR	0.0031	0.1347	3.345	0.3848	-0.3089	0.3949
S/H/LHC/HSL/HVaR	-0.0016	0.0834	3.767	0.1631	-0.2174	0.2754
S/H/HHC/LSL	0.0008	0.0628	3.127	0.1981	-0.1385	0.1882
S/H/HHC/LSL/LVaR	0.0115	0.1017	4.861	0.9014	-0.2288	0.3777
S/H/HHC/LSL/HVaR	-0.0103	0.0461	4.908	-0.3334	-0.1623	0.1399
S/H/HHC/HSL	0.0023	0.1075	3.913	0.1893	-2826	0.3708
S/H/HHC/HSL/LVaR	0.0092	0.1363	5.143	0.8484	-0.2609	0.5601
S/H/HHC/HSL/HVaR	-0.0158	0.0843	3.396	-0.0221	-0.2476	0.1936
MKT	-0.00132	0.0591	6.374	-0.4837	-0.273	0.145
SMB	0.0018	0.0336	3.205	0.3401	-0.0707	0.0981
HML	0.0022	0.0263	3.314	0.1545	-0.0727	0.0779
HC	0.0011	0.0208	3.382	0.2403	-0.0517	0.0668
SL	0.0002	0.0356	3.037	-0.0411	-0.0953	0.0903
VaR	-0.0046	0.0358	4.132	-0.3768	-0.1203	0.0998

Note: P represents the portfolio of all sample firms of the sample periods Sand B represent small size and big size companies. L and H are low book-to-market ratio and high book to market ratio. LHC and HHC represent low and high human capitals, LSL and HSL represent low stock liquidity and high stock liquidity, and LVaR and HVaR represents Low and high VaR.

Table 1 provides the descriptive statistics for market returns, factors, and portfolios for the period of 2015–2023. The market presents a slightly negative mean return reported as (-0.00132), a moderate degree of volatility reported as (0.0591), and possesses a fat-tailed distribution, which confirms extreme downside risk consistent with previous empirical studies examining Pakistan's equity market. In big-sized portfolios, we observe mixed performance. Some portfolios yield modest positive returns (e.g., B/L/HHC at 0.0163) and others yield negative returns and a moderate to high degree of volatility, which indicates continued exposure to tail risk. Small-sized portfolios, by contrast, yield much more beneficial returns; we observe an average return well in excess of zero, including the portfolios S/H/LHC (0.0074) and S/H/LHC/HSL (0.0082), but with more volatility than big-sized portfolios. At the factor level, SMB and HML show positive means, therefore supporting the notion of size and value premiums, while human capital adds very little, stock liquidity adds little, and VaR presents some slight downside loss. In summary, from the descriptive statistics, we find evidence that small firms outperform large firms at increased risk. Additionally, we find that using liquidity and VaR, we capture additional variation in portfolio returns, thereby reinforcing the relevance of extending asset pricing models in the context of emerging markets.

4.2 Correlation Matrix

Table 2. Correlation matrix

	Mean	St. Dev	MKT	SMB	HML	HC	SL	VaR
MKT	2.0017	.56013	1					
SMB	1.9503	.50168	.403**	1				
HML	2.0000	.56199	.044	.010	1			
HC	2.0712	.58050	-.145	-.020	-.156	1		
SL	2.0003	.56754	.598**	-.043	.130	-.023	1	
VaR	2.3456	.56788	-.660**	-.001	-.155	.079	-.667**	1

Note: MKT represents market return above RFR, SMB represents size, HML represents value, HC represents human capital and SL represents stock liquidity, and VaR represents Value at Risk.

Table 2 provides the correlation matrix of the variables of the study. The correlations indicate that market returns (MKT) positively correlate with SMB (0.403**), indicating that small firms exhibit increases in line with market performance levels. Stock liquidity (SL) shows a positive relationship with MKT (0.598**) and a significant negative relationship (-0.667**) with VaR, which indicates that more liquidity leads to lower downside risk. A similar case occurs with VaR and MKT (-0.660**), indicating that greater potential loss tends to occur when market performance is weak. All other correlations were weak and not statistically significant, indicating a lack of multicollinearity among the majority of the factors. In general, the matrix support for liquidity and VaR is a valid extension to standard models of asset pricing.

Table 3, given below, represents the results of the Fama-French three-factor model.

Table 3. Fama-French Three-Factor Model

Portfolios	**Intercept**	**MKT**	**SMB**	**HML**	**Adj-R^2**
P	-0.0065 (-2.78) **	0.99 (22.7) ***	0.5 (6.58) ***	0.035 -0.39	0.83
S	-0.005 (-2.04) *	0.98 (22.1) ***	1.008 (12.59) ***	0.03 -0.32	0.83
SL	-0.007 (-2.59) **	0.97 (18.80) ***	1.011 (11.19) ***	*-0.607* (-5.75) ***	0.78
SH	-0.003 (-0.96) *	0.99 (19.71) ***	1.005 (11.35) ***	0.67 (6.43) ***	0.81
B	-0.008 (-3.41) ***	0.99 (22.56) ***	-0.0007 (-0.01)	0.04 -0.44	0.85
BH	-0.008 (-3.27) *	0,99 (19.9) ***	-0.0009 (-0.01)	0.4 (3.90) ***	0.82
BL	-0.008 (-2.86) **	1.005 (20.655) ***	-0.003 (-0.04)	-0.32 (-3.2) **	0.83

Note: P represents a portfolio of all sample firms; Sand B represents small and big size companies, and H represents low book-to-market ratio and high book-to-market ratio. T values are shown in parentheses, while 10%, 5%, and 1% significant levels are represented in the form of symbols (*, **, ***).

The regression results from the Fama-French three-factor model on the various portfolios can be found in Table 3. The market factor (MKT) is consistently positive and significant across all of the portfolios, which indicates that stock return is highly affected by overall market movements, as expected (Fama & French, 1993)

The size factor (SMB) is positive and significant for the small portfolios (S, SL, SH), indicating that smaller firms earn higher risk-adjusted returns, while insignificant for the big portfolios (B, BH, BL) (Thalassinos et al., 2023). The value factor (HML) produces mixed results of being positive and significant for the high book-to-market portfolios (SH, BH), while negative for the BL portfolio; this implies that value firms outperform growth firms only in certain parts of the value factor (Mubashar et al., 2021). Overall, the intercepts are usually negative and significant, indicating the three-factor model does not fully explain the excess returns of the stocks. The adjusted R² ranges from 0.78 to 0.85, indicating the Fama-French three-factor model explains a large portion of return variability, as there are still unexplained returns.

Table 4. Human Capital-based Four Factor Model

	Intercept	**MKT**	**SMB**	**HML**	**HC**	**Adj-R^2**
P	-0.0067	1.003	0.52	0.06	0.24	0.84
	(-2.92) **	(23.14) ***	(6.85) ***	-0.71	(2.14) *	
S	-0.005	0.99	1.02	0.06	0.26	0.83
	(-2.18) *	(22.59) ***	(13.33) ***	-0.65	(2.21) *	
SL	-0.007	0.97	1.02	*-0.59*	0.07	0.78
	(-2.59) **	(18.57) ***	(11.16) ***	(-5.59) ***	-0.51	
SL.L. HC	-0.004	0.88	0.93	-0.49	0.66	0.7
	(-1.1.5)	(13.95) ***	(8.39) ***	(-3.84) ***	(-3.97) ***	
SL.H. HC	-0.01	1.07	1.11	-0.69	0.82	0.74
	(-3.13) **	(16.32) ***	(9.763) ***	(-5.20) ***	(4.74) ***	
SH	-0.003	1.02	1.03	0.72	0.44	0.83
	(-1.17)	(21.00) ***	(12.17) ***	(7.19) ***	(3.45) ***	
SH.L. HC	-0.0002	1.03	1.09	0.74	-0.18	0.75
	(-0.07)	(15.85) ***	(9.07) ***	(5.53) ***	(-1.031)	
SH.H. HC	-0.006	1.01	0.96	0.69	1.06	0.73
	(-1.69)	(15.73) ***	(8.59) ***	(5.29) ***	(6.26) ***	
B	-0.008	1.01	-0.01	0.07	0.232	0.85
	(-3.55) ***	(22.91) ***	-0.154	-0.741	(1.99) **	
BH	-0.008	0,99	-0.0001	0.4	0.02	0.82
	(-3.25) *	(19.62) ***	-0.002	(3.86) ***	-0.15	
BH.L. HC	-0.01	1.06	0.06	0.33	-0.41	0.79
	(-3.33) **	(17.96) ***	-0.55	(2.74) **	(-2.62) **	
BH.H. HC	-0.007	0.93	-0.05	0;47	0.45	0.79
	(-2.56) *	(17.72) ***	(-0.56)	(4.33) ***	(3.28) **	
BL	-0.008	1.03	0.02	-0.26	0.44	0.84
	(-3.18) **	(22.08) ***	-0.26	(-2.76) **	(3.58) ***	
BL.L. HC	-0.013	1	0.004	-0.23	0.17	0.77
	(-4.02)	(17.26) ***	-0.041	(-1.91)	-1.11	

BL.H. HC	-0.003	1.06	-0.3	-0.3	0.71	0.79
	(-1.08)	(18.36) ***	-0.38	(-2.54) *	(4.66)***	

Note: P represents the portfolio of all sample firms. Sand B represents small-sized and big-sized companies, and H represents low book-to-market ratios and high book-to-market ratios. LHC and HHC represent low human capital and high human capital. T values are shown in parentheses, while 10%,5%, and 1% significant levels are represented in the form of symbols (*,**,***).

The outcomes of the human capital-based four-factor model indicate that the market factor remains the most important contributor to returns, with coefficients near one and statistically significant over the sample across all portfolios, verifying the importance of systematic risk (Fama & French, 1993). The size factor (SMB) is strong and positive for small companies, while the value (HML) factor has somewhat mixed behavior, being overall positive in a few clearly high book-to-market portfolios but negative for some large, low value groups, thus confirming conditional evidence on the value premium (Fama & French, 2017). Significantly, the human capital (HC) factor is positive in the pooled portfolio and in many small and high-HC lower human capital subgroups, suggesting that firms investing in more human capital earn higher returns, consistent with recent work documenting the pricing relevance of human capital (Khan et al., 2023; Maiti & Balakrishnan, 2018). However, some of the large-firm subsamples had an overall negative HC loadings, implying that the size and characteristics of the firm changed the premium for human capital. In general, although adding HC helped improve explanatory power when compared to the three-factor model, there were still significant intercepts, suggesting that additional measures, such as liquidity and downside risk, may be necessary to complete the model (Haqqani & Aleem, 2020).

4.3 Human Capital, Stock liquidity, and VaR based Six Factor Model

Table 5, given below, represents the results of the extended six-factor model.

Table 5. Human Capital, Stock liquidity, and VaR-based Six Factor Model

Portfolios	**Intercept**	**MKT**	**SMB**	**HML**	**HC**	**SL**	**VaR**	**Adj-R2**
P	-0.009	0..70	0.32	-0.04	0.16	0.26	-0.39	0.89
	(0.002) ***	(0.05) ***	(0.07) ***	-0.07	-0.09	(0.08) ***	(0.08) ***	
S	-0.007	0.7	0.82	-0.05	0.17	0.25	−0.38	0.88
	(o.oo2) ***	(0.06) ***	(0.07) ***	-0.08	-0.09	(0.08) **	(-0.09) ***	
SL	-0.009	0.69	0.82	*-0.7*	-0.009	0.2	-0.39	0.83
	(0.003) ***	(0.07) ***	(0.09) ***	(0.09) ***	-0.12	(0.09) *	(0.11) ***	
SLLHC	-0.006	0.61	0.74	−0.59	−0.73	0.09	-0.49	0.73
	-0.003	(0.09) ***	(0.11) ***	(0.12) ***	(0.16) ***	-0.13	(0.14) ***	
SL.H. HC	-0.01	0.77	0.92	-0.81	0.72	0.35	-0.31	0.78
	(0.003) ***	(0.09) ***	(0.12) ***	(0.13)***	(0.16) ***	(0.13) **	(0.14) *	
SL.L.HC.H.SL	-0.005	0.56	0.68	-0.83	-0.99	0.83	-0.39	0.66

	-0.005	(0.14) ***	(0.18) ***	(0.19)***	(0.24)***	(0.19) ***	-0.22	
SL.L.HC.H.SL.H.VaR	-0.006	0.84	0.77	-0.54	-0.33	0.54	0.37	0.46
	-0.005	(0.15) ***	(0.19) ***	(0.21) *	-0.27	(0.21) *	(0.24) ***	
SL.L.LHC.H.SL.L.VaR	-0.02	0.11	0.35	-0.83	-1.41	1.47	-0.89	0.57
	(0.007)*	-0.2	-0.26	(0.28) **	(0.35)***	(0.28) ***	(0.32) **	
SL.L.HC.L.SL	-0.007	0.75	0.91	-0.46	-0.57	-0.63	-0.63	0.5
	-0.005	(0.14) ***	(0.17) ***	(0.19) *	(0.24) *	(0.19) **	(0.22) **	
SL.L.HC.L.SL.H. VaR	-0.008	0.53	0.39	-0.37	-0.03	-0.24	-0.32	0.29
	-0.005	(0.13)***	(0.17)*	(0.18)*	-0.23	-0.19	-0.21	
SL.L.HC.L.SL.L. VaR	-0.01	1.1	1.35	-0.88	-1.31	-1.05	-0.74	0.54
	-0.007	(0.19)***	(0.24)***	(0.26)**	(0.33)***	(0.27)***	(0.29)*	
SL. H. HC. H.SL	-0.008	1.02	1.29	-0.99	0.91	0.74	-0.17	0.72
	-0.005	(0.15)***	(0.18)***	(0.19)***	(0.25)***	(0.20)***	-0.22	
SL.H.HC.H.SL.H.VaR	-0.008	0.91	1.17	-0.74	0.21	0.41	0.24	0.5
	-0.005	(0.16)***	(0.19)***	(0.21)***	-0.27	-0.22	-0.24	
SL.H.HC.H.SL.L.VaR	-0.01	0.95	1.07	-1.07	1.71	1.02	-0.43	0.61
	-0.008	(0.21)***	(0.27)***	(0.29)***	(0.37)***	(0.29)***	-0.33	
SL.H.HC.L.SL	-0.02	0.61	0.58	-0.71	0.42	-0.002	-0.38	0.51
	(0.004)***	(0.12)***	(0.15)***	(0.17)***	-0.21	-0.17	(0.19)*	
SL.H.HC.L.SLH. VaR	-0.02	0.61	0.37	-0.51	0.26	-0.09	0.07	0.29
	(0.005)***	(0.13)***	(0.16)*	(0.18)**	-0.22	-0.18	-0.19	
SL.H.HC.L.SL.L. VaR	-0.02	0.51	0.65	-0.89	0.38	-0.02	-0.76	0.35
	(0.006)**	(0.19)**	(0.24)**	(0.27)**	-0.34	-0.27	(0.29)*	
SH	-0.005	0.71	0.83	0.61	0.35	0.29	-0.38	0.88
	(0.002)*	(0.06)***	(0.08)***	(0.09)***	(0.11)**	(0.09)**	(0.09) ***	
SH.L.HC	-0.002	0.72	0.89	0.63	-0.27	0.34	-0.34	0.79
	-0.003	(0.09)***	(0.11)***	(0.12)***	(0.16)***	(0.13)**	(0.14)*	
SH.H.HC	-0.008	0.71	0.76	0.59	0.97	0.23	-0.42	0.77
	(0.003)*	(0.09)***	(0.11)***	(0.12)***	(0.16)***	(0.13)***	(0.14)**	
SH.L.HC.H.SL	-0.0007	0.95	1.19	0.78	-0.55	1.19	-0.27	0.84
	(0.004)***	(0.12)***	(0.15)***	(0.17)***	(0.21)*	(0.17)***	-0.19	
SH.L.HC.H.SL.H.VaR	-0.008	0.91	0.65	0.34	-0.67	0.69	0.25	0.61
	-0.005	(0.14)***	(0.18)***	-0.19	(0.25)**	(0.19)***	-0.22	
SH.L.HC.H.SL.L.VaR	-0.01	0.78	1.32	1.17	-0.18	1.00008	-1.32	0.81
	-0.006	(0.16)***	(0.20)***	(0.22)***	-0.28	(0.22)***	(0.25)***	
SH.L.HC.L.SL	-0.005	0.64	0.72	0.47	-0.11	-0.41	-0.32	0.43

	-0.004	(0.12)***	(0.15)***	(0.17)**	-0.21	(0.17)*	-0.19	
SH.L.HC.L.SL.H.VaR	-0.005	0.57	0.5	0.08	-0.49	-0.14	0.45	0.24
	(0.,004)	(0.12) ***	(0.14) ***	-0.16	(0.20) *	-0.16	(0.18) *	
SH.L.HC.L.SL.L. VaR	-0.01	0.57	0.63	0.67	-0.03	-0.89	-1.3	0.47
	(0.006)*	(0.17)**	(0.21)**	(0.23)**	-0.29	(0.24)***	(0.26)***	
SH.H.HC.H.SL	-0.009	0.89	0.82	0.49	0.88	0.93	-0.55	0.71
	-0.006	(0.16) ***	(0.19) ***	(0.22) *	(0.28) **	(0.22) ***	(0.25) *	
SH.H.HC.H.SL.H.VaR	-0.02	0.82	0.76	0.43	0.51	0.93	0.37	0.52
	(0.006)***	(0.16)***	(0.20)***	-0.22	-0.28	(0.22) ***	-0.25	
SH.H.HC.H.SL.L.VaR	-0.006	0.98	1.26	0.96	0.94	0.52	-1.37	0.69
	-0.007	(0.21) ***	(0.26) ***	(0.29) **	(0.37) *	-0.29	(0.33) ***	
SH.H.HC.L.SL	-0.009	0.66	0.77	0.63	1.06	-0.36	-0.25	0.42
	(0.005)*	(0.13)***	(0.16)***	(0.18)***	(0.23) ***	-0.18	-0.2	
SH.H.HC.L.SL.H.VaR	-0.02	0.56	0.39	0.42	0.22	0.04	0.48	0.22
	(0.004)***	(0.11)***	(0.14)**	(0.15)**	-0.19	-0.16	(0.17) **	
SH.H.HC.L.SL.L.VaR	-0.003	0.26	0.99	0.83	1.35	-0.45	-1.06	0.28
	-0.008	-0.24	(0.29)**	(0.32)*	(0.41) **	-0.33	(0.37) **	
B	-0.01	0.72	-0.19	-0.04	0.15	0.26	-0.39	0.9
	(0.002) ***	(0.06) ***	(0.07) **	-0.08	-0.09	(0.08) **	(0.09) ***	
BH	-0.01	0,71	-0.19	0.29	-0.06	0.25	-0.38	0.86
	(0.002)***	(0.07)***	(0.09)*	(0.09)**	-0.12	(0.09)**	(0.11)***	
BH.H.HC	-0.009	0.66	-0.24	0.37	0.38	0.15	-0.43	0.83
	(0.003)***	(0.073)***	(0.09)*	(0.09)***	(0.13)**	-0.1	(0.11)***	
BH.L.HC	-0.01	0.75	-0.15	0.22	-0.5	0.35	-0.33	0.84
	(0.003) ***	(0.08) ***	-0.1	(0.11) *	(0.14) ***	(0.11) **	(0.12) **	
BH.H.HC.H.SL	-0.01	0.64	-0.32	0.39	0.22	0.43	-0.55	0.74
	(0.004)**	(0.11)***	(0.14)*	(0.15)*	-0.19	(0.15)**	(0.17)**	
BH.H.HC.H.SL.H.VaR	-0.01	0.51	-0.28	0,31	0.49	0.53	0.02	0.51
	(0.005)*	(0.13)***	-0.16	-0.18	(0.22)*	(0.18)**	-0.19	
BH.H.HC.H.SL.L.VaR	-0.01	0.5	-0.46	0.64	0.33	0.37	-1.09	0.71
	(0.005)**	(0.14)***	(0.17)**	(0.19)**	-0.24	-0.19	(0.21)***	
BH.H.HC.L.SL	-0.008	0,75	-0.19	0.32	0.57	-0.03	-0.26	0.73
	(0.003)**	(0.09)***	-0.11	(0.12)**	(0.15)***	-0.12	-0.14	
BH.H.HC.L.SL.H.VaR	-0.01	0.49	-0.03	0.18	0.29	0.08	0.06	0.37
	(0.004)**	(0.10)***	-0.13	-0.14	-0.18	-0.14	-0.16	
BH.H.HC.L.SL.L.VaR	-0.005	0.85	-0.39	0.49	0.59	-0.32	-0.64	0.59
	-0.005	(0.15)***	(0.19)*	(0.21)*	(0.26)*	(0,21)	(0.23)**	

BH.L.HC.H.SL	-0.01	0.67	-0.28	0.4	-0.46	0.62	-0.43	0.68
	(0.005)*	(0.14)***	-0.18	(0.19)*	(0.24)*	(0.19)**	-0.22	
BH.L.HC.H.SL.H.VaR	-0.01	0.66	-0.03	-0.28	-0.55	0.41	-0.1	0.59
	(0.004)**	(0.12)***	-0.15	-0.17	(0.21)*	(0.17)*	-0.19	
BH.L.HC.H.SL.L.VaR	-0.006	0.66	-0.22	0.55	-0.26	0.53	-0.87	0.55
	-0.007	(0.21)**	-0.26	-0.28	-0.36	-0.29	(0.32) **	
BH.L.HC.L.SL	-0.01	0.9	-0.03	0.05	-0.48	0.09	-0.18	0.79
	(0.003)***	(0.09)***	-0.11	-0.12	(0.15)**	-0.13	-0.14	
BH.L.HC.L.SL.H.VaR	-0.01	0.89	0.34	0.09	-0.22	0.007	0.33	0.54
	(0.003)**	(0.11)***	(0.14)*	-0.15	-0.19	-0.15	(0,.17)	
BH.L.HC.L.SL.L.VaR	-0.02	0.93	-0.43	0.01	-1.08	0.12	-0.39	0.69
	(0.005)***	(0.15)***	(0.18)*	-0.2	(0.25)***	-0.2	-0.23	
BL	-0.01	0.73	-0.18	-0.37	0.35	0.27	-0.39	0.89
	(0,002)***	(0.06)***	(0.07)*	(0.08)***	(0.10)**	(0.08)**	(0.09)***	
BL.H.HC	-0.006	0.74	-0.18	-0.42	0.62	0.23	-0.47	0.83
	(0.003)*	(0.08)***	-0.09	(0.11)***	(0.14)***	(0.11)*	(0.12)***	
BL.L.HC	-0.01	0.72	-0.18	-0.33	0.08	0.32	-0.31	0.81
	(0.003)***	(0.08)***	-0.1	(0.11)**	-0.14	(0.11)**	(0.13) *	
BL.L..HC.H.SL	-0.015	0.75	-0.3	-0.32	-0.02	0.89	-0.18	0.82
	(0.004)***	(0.09)***	(0.12)*	(0.14)*	-0.17	(0.14)***	-0.15	
BL.L.HC.H.SL.H.VaR	-0.006	0.6	-0.19	-0.19	0.06	0.42	-0.17	0.66
	-0.004	(0.10)***	-0.13	-0.14	-0.18	(0.14)**	-0.16	
BL.L.HC.H.SL.L.VaR	-0.02	0.7	-0.53	-0.71	-0.19	0.95	-0.58	0.79
	(0.004)***	(0.13)***	(0.16)**	(0.17)***	-0.22	(0.17)***	(0.19) **	
BL.L.HC.L.SL	-0.01	0.73	-0.03	-0.33	0.03	-0.25	-0.53	0.63
	(0.04)**	(0.11)***	-0.14	(0.15)*	-0.19	-0.15	(0.17)**	
BL.L.HC.L.SL.H.VaR	-0.01	0.59	0.04	0.02	0.27	-0.12	-0.12	0.48
	(0.003)*	(0.09)***	-0.12	-0.13	-0.17	-0.13	-0.15	
BL.L.HC.L.SL.L.VaR	-0.004	0.68	-0.18	-0.57	-0.08	-0.13	-0.7	0.64
	-0.004	(0.12)***	-0.15	(0.17)***	-0.21	-0.17	(0.19)***	
BL.H.HC.H.SL	-0.003	0.79	-0.17	-0.37	0.63	0.58	-0.42	0.76
	‘(0.004)	(0.11)***	-0.14	(0.16)*	(0.19)**	(0.16)***	(0.18) *	
BL.H.HC.H.SL.H.VaR	-0.01	0.74	0.04	-0.16	0.71	0.26	0.01	0.55
	-0.004	(0.12)***	(0.15)***	-0.16	(0.21)***	-0.17	-0.19	
BL.H.HC.H.SL.L.VaR	0.003	0.82	-0.3	-0.82	0.17	0.69	-0.77	0.73
	-0.01	(0.15)***	-0.19	(0.21)***	-0.27	(0.21)**	(0.23) **	
BL.H.HC.L.SL	-0.01	0.74	-0.1	-0.54	0.54	-0.13	-0.56	0.71
	(0.003)*	(0.10)***	(0,13)	(0.14)***	(0.18)**	-0.14	(0.16)***	
BL.H.HC.L.SL.H.VaR	-0.01	0.77	-0..003	-0.16	0.51	-0.008	0.15	0.54

	-0.004	(0.10)***	-0.13	-0.14	(0.18)**	-0.15	-0.16	
	-0.005	0.62	-0.23	-0.65	0.31	-0.02	-0.99	
BL.H.HC.L.SL.L.VaR	-0.004	(0.13)***	-0.16	(0.18)***	-0.23	-0.18	(0.20)***	0.67

Note: P represents the portfolio of all sample firms. Sand B represents small size and large-sized companies and H represents low book-to-market ratio and high book-to-market ratio. LHC and HHC represent low human capital and high human capital. For stock liquidity, LSL and HSL mean portfolios sorted on the basis of low stock liquidity and high stock liquidity, respectively for VaR.LVaR and HVaR mean portfolios sorted on the basis of low VaR and High VaR. T values are shown in parentheses, while 10%,5% and 1% significant levels are represented in the form of symbols (*,**,***).

The six-factor model results reveal that market risk (MKT) is always positive and highly significant across portfolios in all situations, which reinforces its central role in explaining stock returns (Fama & French, 1993, 2017). Results for the size factor (SMB) are highly positive in small-cap portfolios and weak or negative in large-cap portfolios, implying that the size premium is concentrated among smaller firms (Banz, 1981; Hou et al., 2015). The value factor (HML) behaves as expected where high book-to-market portfolios have positive coefficients and low book-to-market portfolios have negative or weak coefficients - consistent with Fama and French (1998) as a traditional value effect. Human capital (HC) shows up as an additional important factor that is significant in several portfolios, in particular portfolios characterized by higher human capital. This evidence coincides with recent research investigating intangible capital related to asset pricing (Eisfeldt & Papanikolaou, 2014; Maiti & Balakrishnan, 2018). The evidence indicates that firms with higher human capital intensity are likely to earn distinct return patterns, which reinforces the importance of integrating knowledge-based resources into pricing models (Khan et al., 2023).

Stock liquidity (SL) typically has negative, significant coefficients, meaning that illiquid stocks earn higher returns as compensation for assuming the liquidity risk (Amihud & Mendelson, 1986). This supports the liquidity-return tradeoff, where investors must receive additional returns to hold assets with less liquidity. The Value-at-Risk (VaR) factor shows negative loadings in many of the portfolios, indicating that portfolios that were more exposed to downside risk earn lower returns, which is consistent with the tail risk pricing previously documented by Bollerslev (1986). These trends correspond to tail-index evidence based on crises of emerging markets. Srilakshminarayana (2021) revealed that the tail behaviour of Nifty-50 equities is adjusted during the periods of crisis, which causes the reclassification of some securities as high-risk ones and the identification of the events of high severity. The present VaR-enhanced model builds upon this knowledge in the explicit measure of downside premia in the Fama-French model, thus validating the finding that the higher the tail exposure, the higher the returns at the expense of the increased vulnerability.

Lastly, the adjusted R^2 values were elevated relative to the four-factor model, showing that the inclusion of HC, SL, and VaR enhanced explanatory power. However, although the intercepts are lower, there are still significant intercept values, suggesting that the six-factor model, while an improvement, does not account for all sources of return variation. The results here extend prior evidence by demonstrating that non-traditional risk dimensions, namely human capital, liquidity, and downside risk, are relevant for the pricing of returns in the studied market.

In addition, the findings emphasize the variability in both magnitude and sign of the factor loadings across portfolio characteristics, suggesting that firm-specific characteristics contribute to risk-return characteristics. Small, high book-to-market portfolios with significant human capital exposure exhibit positive loadings on SMB, HML, and HC, suggesting that firms are capitalizing on premiums from size, value, and one based on intangibles, simultaneously. On the contrary, large portfolios with low human capital, or highly liquid portfolios, exhibited weak or negative exposures, suggesting that stability and efficiency come at the cost of excess return. The difference demonstrates evidence of what Fama and French (2015) and Novy-Marx (2013) argue that multifactor models explain cross-sectional differences better than single-factor models with firm fundamentals. Additionally, it suggests that investors in countries like Pakistan may achieve better risk-adjusted returns by tilting their portfolios towards small, value-focused, knowledge-based firms, regardless of the risks these firms entail, particularly the additional volatility and liquidity risk associated with them compared to larger, well-established firms.

4.4 Comparison between the FF3FM, FF4FM, and FF6FM

The Fama-French three-factor model (FF3FM) explains returns based on market, size, and value effects. While the BF3FM had some explanatory power in the highest returning portfolio, that power was relatively weak. This is particularly evident in Pakistan's emerging equity market, which introduces greater volatility and also requires consideration of omitted risk factors (Harvey, 1995). In contrast, the four-factor model (FF4FM) that includes human capital produced a greater adjusted R^2 and better captures the risks associated with labor intensity and knowledge intensity compared to the FF3FM. This is consistent with the results in Eisfeldt and Papanikolaou (2014) where firms with lower risks associated with hiring and labor have greater returns than firms that do not. The five-factor model (FF5FM) adds profitability and investment factors to the explanations of stock returns and includes previously mentioned labor and knowledge intensity. Though noting the factors of profitability and investment used in the FF5FM, the investment factor is weak in the models run in Pakistan due to market inefficiencies, but still produced results consistent with Hou et al. (2015). The six-factor model (FF6FM) is defined similarly to FF4FM, but adds stock liquidity and Value-at-Risk (VaR). The FF6FM captured greater return explanations due to the inclusion of stock liquidity and VaR, whereas the liquidity premium is consistent with the work of Amihud and Mendelson (1986), the VaR component captures downside risk as described by Bekaert et al. (2007). The experimental findings support the value of the controversial extension of the Fama-French three-factor model, which is supported by prior extensions of the literature on Pakistan, e.g., Khan et al. (2022). They are also consistent with the methodological criticism that Allen and McAleer (2023) have put forward and have found defects in the original factor model and screening processes that are used by Fama and French (2015, 2017). The proposed six-factor specification would help to mitigate some of these concerns by combining liquidity measures and Value-at-Risk (VaR) elements, providing a greater ability to explain downside risks and liquidity premia in emerging market situations. In conclusion, while the FF3FM provides an appropriate base return explanation, it is the FF6FM that provides the most comprehensive pricing mechanism in terms of the Pakistani equity market.

5 Conclusion

Traditional asset pricing models such as CAPM, Fama-French Three Factors Model (FF3FM), and Fama-French Five Factors Model (FF5FM) have historically been used to explain stock return behavior. Although the aforementioned models may capture the relevant factors in developed markets, they often fail to account for all the relevant risks in emerging markets such as Pakistan, where liquidity issues, volatility issues, and institutional inefficiencies also play significant roles (Sarwat et al., 2019). The results from this study address this concern by demonstrating that if you extend the Fama-French model to include human capital, stock liquidity, and Value-at-Risk (VaR), you can provide a better explanation to the investor about risk-return.

Traditional facets such as market, size, and value maintain significance as well: small-cap companies produce higher returns on a risk-adjusted basis than large-cap companies, and value stocks outperform growth stocks (in line with previous evidence, Chikwira & Mohammed, 2022). The negative intercepts suggest that the baseline models alone could not explain returns, indicating the models should factor in additional variables. The substantially high adjusted R^2 values (above 0.70) further indicate that extended models, which included liquidity and VaR, substantially improved explained variance in predictive ability. Though human capital had a positive contribution, the effect of this variable also depended on the firm's use.

Liquidity appears to be a strong predictor of returns: higher liquidity reduces risk premiums that attract investors, but too much liquidity can reduce returns. VaR is a useful measure of downside risk, where higher VaR portfolios will provide the potential for higher returns but also higher uncertainty (Bekaert et al., 2007).

The models showed a comparison of the FF3FM model, which included size and value effects, but were not robust enough to capture these effects for emerging markets. The FF4FM explicitly included human capital, which improved the model, but the effects were dependent on the sector. Meanwhile, the FF5FM model works in other contexts but was not as relevant for Pakistan. FF6FM with liquidity and VaR consistently outperformed, including market-relevant risk features, helping to explain. These results also argue in favor of ascertaining which asset pricing models need to consider local market specificities.

More generally, changes in practice and policy implications are also applicable here for investors, regulators, and financial institutions. An investor may construct a portfolio that embeds liquidity and downside risk, a regulator could consider policies that aim to create liquidity and market efficiency, and financial institutions may explore embedding this approach into their respective risk management frameworks. Therefore, the findings of the FF6FM model specific to Pakistan’s context is of both theoretical and practical value.

5.1 Limitations and Future Research

While I have attempted to provide a succinct account of the study limitations, it is important to acknowledge that they are at least threefold. The study is historical and draws on data from Pakistan (2015–2024). No aspects may reflect future trends, or may not be wholly transferable to other markets. Data quality and reporting problems when collecting data from emerging economies are also a significant limitation.

Future research may wish to examine the extended model among other developing and mature markets, evaluate cross-country comparison performance, and control for factors such as macroeconomic performance, investor sentiment, and ESG dimensions. When possible, assessing the model under crisis conditions may also give greater clarity, and advanced statistical tools, such as machine learning techniques, may also be superior options and provide stronger predictive power.

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