

FINANCIAL CONSTRAINTS: A MYTH OR REALITY? AN EMPIRICAL EVIDENCE FROM PAKISTAN STOCK EXCHANGE

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Abstract

Purpose of the study: This study investigates the stock pricing of financially constrained (FC) firms in Pakistan for the period of 20 years (2000 to 2019). The researcher uses accounting information (financial ratios of the firms) to categorize Pakistani firms as the most and least financially constrained firms. Further, it examines how the Asset Pricing models perform with the risk-adjusted portfolio of the stock returns sorted based on financial constraints.

Methodology: Using the financial constraint proxies/ leverage ratios (Total Debt to Market Value(TDMV), Total Debt to Common Equity (TDC), Interest Coverage Ratio (ICR) and the asset pricing models of [Sharpe \(1964\)](#), [Lintner \(1965\)](#), and the three-factor and the five-factor model of [Fama and French \(1993, 1996\)](#), the returns of all the non-financial firms listed in PSX were sorted as the most and the least financially constraint firms and then their risk-adjusted portfolios were analyzed through Excel, Eviews and STATA.

Main Findings: Positive results (e.g. higher returns) are observed when the capital structure of the FC firms is heavy with debt as compared to unconstrained firms on Pakistan Stock Exchange (PSX). The time series outcome showed that risk-adjusted returns of most FC firms give an extra premium to investors in the PSX when the leverage ratios are used as proxies of financial constraints.

Applications of the study: This study can be used to make an augmented model of asset pricing specifically for emerging and frontier markets by taking the FC factor as one of the main contributing risk factors to predict returns in the equity market.

Novelty/Originality of the study: The devised methodology also results in a more refined and accurate quality of analyses and findings and more comprehensive and sound knowledge of asset pricing as compare to previously conducted studies in PSX.

Keywords: Financial Constraints, Pakistan Stock Exchange, Asset Pricing Models.

INTRODUCTION

According to the literature, there are more than 150 risk factors that have been identified in different equity markets to predict stock returns. Their predictability shows that the equity market is full of surprises, and the investors also devise their investing strategies to capture more returns than normal in different equity markets. Similarly, one of the main goals of empirical asset pricing is the prediction of expected returns. The asset pricing theory argues that in an efficient capital market, the higher expected returns are compensation for higher risk. Resultantly, most of the research in the field of asset pricing has been dedicated to identifying risk factors in the cross-sections of their stocks and the risk associated with them ([Collet & Tobias, 2021](#)). The frictions or financial constraints (FC) are considered as one of the risk factors (anomaly) in the capital market, hence it needs to be studied for understanding their impact on stock returns. Consequently, by using different proxies and indices (to measure financial constraints) the literature recorded mixed evidence from different countries and in different settings. For instance, [Balafas \(2015\)](#) concluded that the investors who are investing in the most financially constrained firms didn't get a premium on the London Stock Exchange (LSE) compared to the least constrained firms that forced the investors to take a long position in case of holding the least FC firms' stock and become short otherwise. [Kaplan & Zingales \(1997\)](#) and [Lamont et.al. \(2001\)](#) also reported lower average returns of FC firms in the capital markets. On the contrary, [Whited & Wu \(2006\)](#), [Gomes et. al. \(2006\)](#), [Livdan et. al. \(2009\)](#), and [Shaikh et al., \(2021\)](#) concluded that the most constrained firms earn higher returns.

These conflicting pieces of evidence in literature from the developed markets are difficult to interpret in the emerging and frontier markets as the socio-economic and market dynamics are different from the rest of the world. Specifically, this study is important to conduct in countries like Pakistan, where the financial intermediary development is low, stock markets are inefficient, GDP is low and legal systems are inefficient ([Asmat & Iqbal, 2017](#)). Moreover, the firms listed in PSX are characterized as having concentrated ownership, family-controlled, interlocking directorship and cross-shareholdings ([Cheema, 2003](#); [Zaidi & Alam, 2015](#)). All these factors contribute to making external funds costly, and the firms show more dependency on internally generated funds and become financially constrained.

The financial market of Pakistan; the Pakistan Stock Exchange (PSX) is considered one of the frontier markets by MCSI and its context and financial institutions are operating in different settings; moreover, the factors of financial constraints have not been studied here yet. To fill this gap, we tried to study FC factors' impact on risk and return estimations of the firms listed in the PSX. Moreover, the asset pricing models that we use to predict stock returns (CAPM, Fama French 3 factor, and Fama French 5 Factor model) have been used to answer the following research questions:

1. How do portfolio returns of financially constrained firms, sorted based on debt to common equity, debt to market value and interest coverage ratio perform at explaining the cross-sectional and time-varying stock returns in Pakistan's stock market?
2. Are the leverage ratios (total debt to common equity, total debt to market value, and interest coverage ratios as FC sorting criteria), a better predictor of stock returns in PSX?
3. How can we compare the performance of equally weighted and value-weighted portfolios of stock returns in the Pakistan stock market?
4. Are FC factors priced in the Pakistan stock exchange?
5. Among CAPM, Fama French 3 and Fama French 5 factor, which is the better model or predictor of stock returns if sorted on FC factors?

Objectives of the Study

Based on the literature, the recent study has the following objectives

1. To sort out the financially constrained and unconstrained firms in Pakistan Stock Exchange (PSX) on the basis of leverage ratios
2. To test the various asset pricing models; CAPM, Fama French 3, and Fama French 5 in PSX.
3. To contribute in the body of financial knowledge and to help investors in making wise investment decisions in PSX

LITERATURE REVIEW

Asset Pricing Research Evolution and Financial Constraint Factor

The relationship between stock returns and risk is of interest to researchers as well as for investors as it is the core of every investment decision. Determining and predicting the prices of the assets in capital markets is always an area of interest and investigation for researchers. The first model in asset pricing was developed by Sharpe and Lintner (1965) known as the Capital Asset Pricing Model (CAPM) which gave a method of estimation of expected returns. The equation of CAPM is narrated as a Stock's expected return is equal to a riskless rate R_f plus a risk premium compounded by Beta and risk premium ($R_m - R_f$). After him, [Fama and French \(1992, 1993, and 1995\)](#) proposed a three-factor model that describes variations in stock return. The three factors are Book Market ratio, Size, and Excess Market returns ([Thompson, 2016](#))

The equation of the model is

$$r = R_f + B_3 (k_m - R_f) + b_s \text{SMB} + b_v \text{HML} + \text{Alpha}$$

SMB = Small market capitalization Minus Big Market capitalization
HML = High book to market ratio Minus Low b/market ratio

Traditionally, the approach used to separate or identify financially constrained firms is to group them based on their characteristics. At first, [Fazzari et al. \(1988\)](#) separate firms into groups based on sorting criteria (Characteristic) then afterwards, the firms are grouped based on financial constraints by [Hadlock et al. in 2010](#). [Almeida et al. \(2004\)](#) use univariate sorting criteria based on firms' payout ratio, size, bond rating, and commercial paper rating to identify the least and maximum FC firms in the sample. The firms believe to become financially constrained due to their capital structure, size of the business, liquidity of their assets and the liabilities recorded on their balance sheet, and the inflow and outflows of their cash flows. To measure this risk, the researchers took proxies from previous research. The proxies include debt to book equity, debt to market value and interest coverage ratios.

Pakistan has a population of 220 million (almost 22 crores) and stands as the 5th largest in the World total population of 7 billion with per capita income of \$1186 in 2020-2021 ([Economic Indicators, Pakistan Finance Division, 2021](#)) with having 36% of the economy unaccounted. The economy of Pakistan is the 42nd largest in terms of nominal Gross domestic product (GDP of \$284 billion) and the 22nd largest (\$1.1 trillion) in the world in terms of purchasing power parity (PPP)¹. Pakistan has considered a developing country having major exports of leather and sports goods, chemicals, carpets/rugs, and textiles. From its inception in 1947, the first five decades from 1947-1997, Pakistan's economic growth rate was higher than the average World's economy. The average growth rates per decade were 6.8%, 4.8%, 6.5%, and 4.6% in 1960, 1970, 1980, and 1990 simultaneously. However, the economy has been characterized as unstable and highly vulnerable to external and internal shocks. Also, Pakistan's economy is less integrated with the global economy and this kept the economy insulated to some extent in comparison to its neighbouring countries like India and China ([Draz, 2011](#)). According to Fitch Ratings, the international credit rating agency, the Pakistani Banking system has evolved from a weak, state-owned to a slightly healthier and private sector-driven system ([Azmat & Iqbal, 2017](#); [Ullah et al., 2021](#))

¹World Economic Outlook Database October 2020". *International Monetary Fund*. Retrieved 24 December 2020

Similarly, Capital markets also play an important role in economies; they try to mobilize domestic savings and convert them into productive investments, likewise; stock markets are institutions of considerable interest to the Public and economists. Pakistan had three stock exchanges in the past; Karachi, Lahore, and Islamabad Stock exchange which merged to become Pakistan Stock Exchange in January 2016 providing a single platform to investors. Based on improved macro-economic indicators, government-friendly investment policies, and reforms by the Securities and Exchange Commission of Pakistan, Morgan Stanley Capital International (MSCI)² upgraded Pakistan's status from Frontier Market to Emerging Markets in the 2016 capital Market, Report of Economic Survey of Pakistan, 2016-2017). The category is achieved by fulfilling the criteria to become an MCSI member by having at least three companies that have a market capitalization of \$1.5 billion. ³The profile of PSX is as follows

Table 1: Profile of Pakistan Stock Exchange

	2015-16	2016-17	2017-18	2018-19	2019-20 (till 31.03.20)
Total No. of Listed Companies	559	560	558	544	530
Total listed Capital, Rs. in million	1,289,081	1,317,220	1,297,375 1	1,340,270 1	1,387,439
Total Market Capitalization - Rs in Million	7,588,472.20	9,522,358	8,665,045	6, 887,301	5,620,941
New Companies Listed during the year	4	5	6	2	0
Average Daily Shares Volume – (Shares in Million) (YTD)	221	363	187	164	194
Total Volume traded - (Million) (YTD)	55,430.30	88,599	46,532	39,943	52,843

Source: Pakistan stock exchange

If we compare the performance of the Pakistan Stock Exchange to the different markets of the world, then the data showed on the MSCI index for Pakistan showed that the Pakistan Stock Exchange remained underperformed from ASCI and MSCI Emerging markets in 2017 and 2018 (see footnote 17 for reference to MSCI Pakistan Index 2018). Again the MCSI rating is changed recently and they placed PSX in frontier markets (MCSI rating 2021). If we take a look at the performance of PSX over the period, it was considered the most liquid exchange and best performing stock market in the world in 2002. During 2006 and 2007, foreign investors were actively investing in PSX, however, in 2007, Standard & Poor's cut its outlook for Pakistan's credit rating from "stable" to "positive" and at the end of 2007, placed Pakistan as "under review". The un-certainties over security, troubling macroeconomic scenarios, double digit inflation, budget deficit every year and current account deficit, and the COVID-19 negative impact created a dark cloud over the economy and the firms operating in Pakistan are facing financial constraints more than ever.

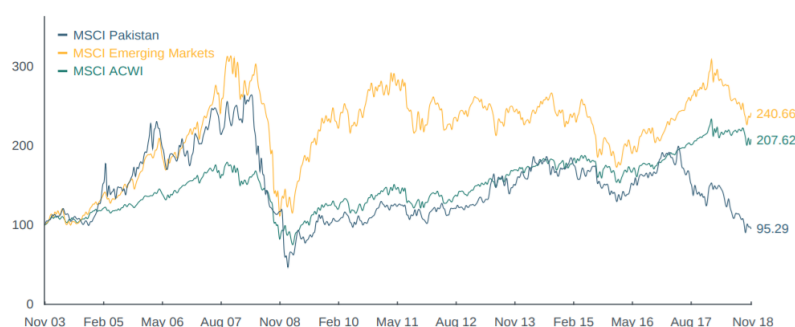
Data and Data-Set Issues

The dataset for this research consists of all common stocks listed on the Pakistan Stock exchange (PSX) that are available in Thomson DataStream from 2000 to 2019. The accounting data for all the FC proxies is also extracted from

²Morgan and Stanley Index

The MSCI Pakistan Index is designed to measure the performance of the large and mid cap segments of the Pakistan market. With 5 constituents, the index covers approximately 85% of the Pakistan equity universe.

CUMULATIVE INDEX PERFORMANCE - PRICE RETURNS (USD) (NOV 2003 – NOV 2018)



ANNUAL PERFORMANCE (%)

Year	MSCI Pakistan	MSCI Emerging Markets	MSCI ACWI
2017	-28.05	34.35	21.62
2016	32.73	8.58	5.63
2015	-18.27	-16.96	-4.26
2014	7.58	-4.63	2.10
2013	26.50	-4.98	20.25
2012	23.46	15.15	13.43
2011	-17.08	-20.41	-9.41
2010	19.49	16.36	10.42
2009	78.07	74.50	31.51
2008	-75.39	-54.47	-43.54
2007	32.50	36.46	9.64
2006	-1.65	29.18	18.78
2005	56.49	30.31	8.83
2004	8.61	22.45	13.30

³The three Pakistani companies which have market capitalization of \$1.5 billion and float market capitalization of \$766 million are MCB (Muslim Commercial bank, Habib Bank (HBL) and Oil and Gas Developing Company (OGDCL). A single deletion of these companies will lead Pakistan from Emerging to frontier Markets.

Source: <https://www.msci.com/documents/10199/4e300cf1-78ba-409a-ba9c-68092c928396>

2000 to 2019 from the DataStream. The data is inclusive of all listed and delisted firms of the Pakistan Stock Exchange to avoid any potential form of survivorship bias. This is the common procedure followed in Literature by other researchers like [Florackis et. al. 2011](#) and then [Balafas 2013](#) for UK firms. We then screen the data at different levels, for the initial screening, we exclude Unit trusts, ADRs, and Investment Trusts. Then we exclude the financial firms and Insurance companies as their capital structure is fundamentally different and they are not comparable to the rest of the firms. At a third level, we sort out the firms which are dead over the period or delisted from the market and their data is not available for one or more than one financial year. First, we identify them, then we put “-1” on their subsequent death month and after that, we put “#NA/N” for the rest of the month’s entries. Likewise, for the missing values in the data, we again put #NA/N. After cleaning and screening the data, we left with 785 non-financial firms that are listed in PSX from 2000 to 2019.

After screening and cleaning the data, discrete returns are calculated from the monthly share prices. For the risk-free rate, the 6-month T-bills rate was used, and this data is extracted from the State Bank of Pakistan Website. The rate is then annualized to use in the research by dividing it by 12 and multiplying it by 100. The market portfolio returns are proxied by Karachi 100 Index. For the Asset Pricing test, we use Size, value, Investment, and Profitability factors for Pakistan Stock Exchange. The data on these factors is not available in Pakistan so we calculate each factor by first preparing the data files in Excel and then by using Stata codes, these factors are calculated to run the CAPM, FF3, and FF5 asset pricing models in E views.

The data for financial constraints were also taken from the Thomson Reuters data stream. The total number of three different series were taken for the proxies of financial constraints for this research. These proxies have data on the firm’s debt, liabilities, equities, and cash flows. The 2008 global crisis period is also part of this study and that has affected the PSX in that period, the firms who are financially constrained had no excess to credit as the market is already in crisis. So, the researcher expects that would have intensified as credit supply is restricted, cash flows of the firms are reduced and the cost of borrowing is increased. Table 3.1 presents the list of these proxies with their definitions and Data Stream codes.

The dataset taken from PSX during the period 2000-2019 was sorted against each FC measure. The Post-ranking returns of these portfolios are calculated to examine the potentially differential behaviors of the most constrained firms to the least constrained firms through FC sortings. The standard Asset pricing tests have been applied to check whether these factors can help to explain the cross-section of these portfolios or not.

The accounting data for the FC proxies have been taken monthly from Thomson Reuters but the figures of accounting data remained the same throughout the year as there is no difference in data monthly. By taking the FC measures for each firm “i” at a time “t” and making their decile portfolios where Portfolio 1 (P1) contains the shares of the least constrained firms of PSX, and Portfolio 10 contains the shares of the Highly constrained firms of PSX. After that, we calculate the post-ranking return (*i-e next month, t + 1*) returns more than the risk-free rate. Next, we calculate both equally weighted and value-weighted portfolio returns for providing comprehensive evidence from the Pakistan Stock exchange, but we rely on Value Weighted Portfolio Returns for calculating CAPM beta and for the interpretation of results as evidence from the literature. The accounting information for all the financial constraints has been taken annually and then the same value has been reported monthly as the firms listed on Pakistan Stock Exchange make their financial statements at the end of the year i-e in December. The values of the previous year are implemented in the next year's monthly sheets i-e the accounting values of Liabilities, interest charges etc. in December 2000 are used for January 2000 till December 2001 till the next financial statement came.

Estimation Methodologies

In the following sections, we discuss both the time-series and cross-sectional regression tests in the context of asset pricing models to see whether the financial constraint factors like total debt to common equity ratio, total debt to market value and interest coverage ratio; priced in PSX or not? These asset pricing tests are built up around two basic techniques: time-series regression and cross-sectional regression. [Black et al. \(1972\)](#) apply the time-series approach that is based on regressing the excess returns of the portfolios on one or more explanatory variables over a period. The resultant time-series slopes are the factor loadings that are termed risk factors. The time-series regression assumes that the average risk premium of the explanatory variables is the average of the explanatory variables. Therefore, [Fama and French \(1993\)](#) argue that the slopes of the time-series regressions give evidence that the risk factors capture the performance of the returns of the stock. Conversely, the cross-sectional regression of [Fama & MacBeth \(1973\)](#) uses the factor loadings of the time-series regressions as inputs in explaining the cross-sectional variation in asset returns. Consequently, [Cochrane \(2013\)](#) mentions that the time-series regression is the limiting case of the cross-sectional regression that can particularly be utilized only when the illuminating variables are returned and results from the time-series and cross-sectional regression tactics are not necessarily similar.

The risk-adjusted returns of the portfolios (from the different sorts) are called the abnormal returns, they show the portion of anomaly return left unexplained by different sorts (Fama and French, 2008) After portfolio formation, abnormal returns are investigated where we regressed the portfolio returns against risk factors as in my case, the portfolio returns are regressed against financial constraint factors. We commonly use the Capital Asset Pricing Model of

Sharp (1964) and Lintner (1965) (CAPM) to estimate the abnormal returns. Afterwards, we use the Fama French three-factor (1993) and Fama and French five-factor model (2015) for abnormal returns estimation. The abnormal returns are the regression intercepts based on these three models.

$$E(R_{it} - R_{ft}) = \alpha + \beta[ER_{mt} - R_{ft}] \quad (1)$$

$$R_i = R_f + \beta_i^{mkt} RMRF + \beta_{i\ size} SMB + \beta_{i\ value} HML + e_{it} \quad (2)$$

$$R_i - R_{ft} = \alpha_i + \beta_i(R_m - R_f) + \beta_{i\ size} SMB + \beta_{i\ value} HML + \beta_{i\ profit} RMW + \beta_{i\ invest} CMA + e_{it} \quad (3)$$

Where $(R_{it} - R_{ft})$ is the raw return of portfolio i in excess of the risk factor R_{ft} .

$R_{mt} - R_{ft}$ is the excess return of the value-weighted PSX index known as the Market risk factor?

SMB (the outperformance of small companies versus big companies) is the size factor, and HML (outperformance of high Book/market⁴ versus Low Book/market⁵ firms) Book/market factor.

RMW is the profitability factor, and this is calculated by taking the difference between the low and the high operating profitability.

CMA is the investment factor, and it is the difference between the returns of the firms investing conservatively and aggressively. According to Fama and French (1993), the SMB factor can be constructed by taking the return difference between large market capitalization stocks to small market capitalization stocks; and HML is the return difference between the portfolios of a low book to market ratios to portfolios with high book to market ratio.

To gauge the risk-adjusted performance of the stocks; time-series analysis provides a simple and clear insight. To develop an understanding of time-series regression tests, the capital asset pricing model of Sharp and Lintner (1964) is taken first:

$$R_{i,t} - R_t^f = \alpha_i + \beta_{i,MKT}(R_{m,t} - R_t^f) + \varepsilon_{i,t} \quad (4)$$

Where $R_{i,t}$ is the return of portfolio " i " in month t , R_t^f is the risk-free rate for the month t , $(R_{m,t} - R_t^f)$ is the excess market portfolio return in the month t , and $\beta_{i,MKT}$ is the exposure of portfolio " i " to the R_m and defined algebraically as:

$$\beta_{i,MKT} = \frac{Cov(R_{i,t}, R_{m,t})}{Var(R_{m,t})} \quad (5)$$

The main intuition of the CAPM is focused on the mean-variance efficiency (i.e., to minimize the variance at a given level of expected return) concept of Markowitz (1959). In this regard, Black et al. (1972) suggest that for the market portfolio to be mean-variance efficient, the following first-order condition must be satisfied:

$$\partial(R_{i,t} - R_t^f) = \beta_{i,MKT} \partial(R_{m,t} - R_t^f) \quad (6)$$

Therefore, combining and comparing equation (3.11) with the first-order condition in equation (3.13) results in a parameter restriction for testing the capital asset pricing model, which is expressed in the following null hypothesis:

$$H_0: \alpha_i = 0 \quad (\text{for } i = 1, 2, 3 \dots \dots 10) \quad (7)$$

Equation 3.14 is important in evaluating the performance of stocks. Commonly, the beta of the CAPM is regarded as the measure of security risk sensitivity to market return, and as per the assumption of the CAPM, the intercept term is considered as zero. However, Jensen (1968) introduces the CAPM alpha as an important measure of the performance of stocks. The intercept term in the CAPM regression is known as the Jensen alpha (α_{jensen}) after Jensen (1968).

Generally, the Jensen alpha is the measure of the ability/characteristic (like FC factors) of certain portfolios. when the stocks are stacked based on certain characteristics in the portfolio; they add value over and above the return implied by the beta risk. In the regression model, only positive point estimates of the Jensen alpha (α_{jensen}) are not important, but they should also be statistically significant.

When we estimate the FC measures against stock returns, the performance of the CAPM, and the Fama-French three and five-factor models are compared. The corresponding alphas of the Fama-French-3 and Fama French-5 factor model are termed as Fama-French alpha (α_{FF}).

To test for the joint significance of the alphas of the decile portfolios and to mitigate potential errors-in-variables problems, a system-based estimation has been used that is Generalized method of moments (GMM) with Newey-West (1987) standard errors corrected for heteroscedasticity and serial correlation are used.

⁴Customary called the Value stock that is buying securities that seem underpriced.

⁵Stock having Low book to market ratio are known as growth stock. Growth stocks generate sustainable and positive cashflows over period and its earnings are high than the other companies of the same industry.

There are different estimation methodologies by which cross-sectional analysis can be carried out. In this study, we use the standard two-stage [Fama and MacBeth \(1973\)](#) methodology to test the cross-sectional explanatory power of financial constraints in the CAPM, Fama-French, and Fama French 5 factor model.

Generalized Method of Moments (GMM)

In the literature on asset pricing, most researchers use Ordinary Least Square regression to determine the parameter coefficients under the assumptions of multivariate normal return distributions ([Fama and French, 1992, 1993](#)). The Generalized method of moments is an estimation procedure that allows economic models to be specific while avoiding unwanted assumptions such as specifying distribution error. That's why, the GMM estimators are known to be consistent, asymptotically⁶ normal, and efficient⁷ in the class of estimators. GMM was first advocated by Lars Peter Hansen in 1982 as the method of moment⁸, introduced by Karl Pearson in 1894. Other methodologies like the Maximum Likelihood method (ML) give OLS estimates but with inconsistent standard errors; likewise Generalized Least Square (GLS) has restrictions for small samples. On the other hand, the GMM retains OLS estimates with consistent standard error for non i.i.d distributions (for example, knowing that the stock returns are not i.i.d⁹ normal. Hence GMM is flexible to obtain an asymptotic set of corrections for statistical model misspecifications of time-series regression coefficients.

WALD Test

Apart from the significance of returns differentials among the extreme deciles, an interesting question is whether an asset pricing model can explain the time-series behavior of the risk factors. To analyze the joint significance of all the intercepts or pricing errors, the Wald test is employed. The test is named after Abraham Wald, and it measures constraints on statistical parameters based on the weighted distance between the unrestricted estimates, and hypothesized value under the null hypothesis. The more the weighted distance, the it is less likely that the constraint is true.

Hypothesis Testing

H₁: There is no spread exists between portfolios P1 and P10 using CAPM.

H₂: There is no spread exists between portfolios P1 and P10 using Fama French 3 factor three-factor model.

H₃: There is no spread exists between portfolios P1 and P10 using Fama French five-factor model.

In this study, Microsoft Excel is used for data cleaning, examining and data sorting. For the construction of decile portfolios, Macros are used in Excel, and finally, E-Views is used to run Generalized Method of Moments (GMM) with Newey-West bandwidth selection and Wald Test for joint significance. The Null Hypothesis, in this case, was that all alphas of the 10 portfolios are zero.

Descriptive Analysis

The empirical results shows the descriptive analysis of the equally weighted and value-weighted portfolios based on each of three proxies taken for financial constraints for this research.

The descriptive tables 2, 3 and 4 have the descriptive characteristics of equally weighted and value-weighted decile portfolios. These portfolios are created through Excel by using three financial constraint proxies for the period of nineteen years starting from January 2000 to June 2019. These tables have the values of annualized average post-ranking returns of value-weighted decile portfolios sorted on leverage ratios: proxies of financial constraints, the market value of these portfolios and the CAPM beta values. In each case, the P1 stands for the portfolio of the least FC firms and the P10 stands for the portfolio of the most FC firms. The last two column reports the difference between P10 and P1 and their corresponding t-test values against the null hypothesis that the characteristics of P10 are equal to the characteristics of P1.

In **tables 2 and 3**, the leverage ratios are used as sorting criteria as proxies of financial constraints. Table 2 uses the Total Debt to Total Common Equity Ratio while table 3 uses the Total Debt to Market Value Ratio. In general, the firms with low leverage ratios have low market values (Balafas 2013) but in our case, the firms with low leverage ratios have high market values and the firms with highest leverage ratios have low market values. In terms of performance, we see that there is piece of evidence that there is a relationship between average excess returns and leverage ratios. In the case of Total Debt to Total Equity Ratio, when we see the VW returns, the spread between P10 (high leverage portfolio returns)-P1(low leverage portfolio returns) is almost 20% per annum and is statistically significant. Furthermore, on the contrary, when we use the total debt to market value ratio as sorting criteria, the value-weighted annualized portfolio

⁶ "In mathematics and statistics, an asymptotic distribution is probability distribution that is the "limiting" distribution of a sequence of distributions".

⁷ While comparing various statistical procedure, efficiency is a measure of quality of an estimator, for a hypothesis testing procedure.

⁸The method of moments; in statistics is method of estimation of population parameters.

⁹Independent and ideally distributed (i.i.d) is a collection of random variables in probability theory, if each random variable has the same probability distribution as the other and all are mutually independent.

returns spread P10-P1 is almost 8% but this difference is not statistically significant. The Beta estimates of P10 are higher than the beta estimates of P1. So as per the portfolio theory and intuition, the portfolios of leveraged firms are producing more returns than the low leverage firms and their CAPM beta shows that the firms with high leverage ratios are riskier than the low leverage firms.

Then **Table 4 shows the result of VW risk-adjusted portfolios using the Interest Coverage ratio** as sorting criteria as a financial constraint proxy. The table showed that the firms with high EBIT or high-interest coverage ratios give low returns as compared to the firms with low EBIT and low-interest coverage ratios. Their correspondence CAPM beta values also showed that they are risky. The spread between P10- P1 is significant for EW portfolio returns. The market capitalization values also suggest that the firms with the lowest interest coverage ratio (most FC firms) are mostly traded over the sample period and the investors get excess returns for taking extra risk.

The overall descriptive results show that most FC firms yield higher returns relative to the returns of the least constrained firms. In other words, we can say that the portfolios of the most constrained firms outperform the portfolios of the least constrained firms and these results are also aligned with the literature.

Risk-Adjusted Performance or Time Series Results

In the above section, we analyzed the performance of portfolios constructed based on financial constraints proxies in terms of their average excess post-ranking returns without making any adjustments for any of the risk factors. In this section, the risk-adjusted performance of these portfolios is presented. Specifically, we estimate the abnormal performance of the portfolios from P1 to P10 according to each financial constraint proxy, using the asset pricing models. In this research, we check the performance of the portfolios by taking CAPM, Fama French 3, and Fama French 5 factor models for the period of January 2000 to June 2019.

We report alphas estimated through the Generalized method of moment, which is known as GMM, with Newey-West Standard Error corrected for heteroscedasticity and serial correlation via system equations. The joint significance of alphas is tested through the WALD test where the null hypothesis is that “**All Alphas are equal to zero**”. The WALD test reports the Chi-Square value for the asymptotic chi-square distribution. This test is applied to verify whether the null hypothesis (mentioned above where $H_0 = \alpha_i = 0$ for $i = 1, 2, 3, \dots, 10$) of zero alpha estimate is True and it explains the significance of differential returns between the most and the least financially constraint portfolios (P10-P1). It also helps in answering the most crucial research question as to what extent the asset pricing models explain the time-series behavior of the portfolios based on different sorts of financial constraints.

Table 5 and 6, Tables for leverage ratios; Debt to Common Equity and Total Debt to Market Value reports the alphas using the first and second sorting criteria, proxies for financial constraint. The investors are rewarded high returns for investing in high leveraged firms relative to low leveraged firms. In table 5, we observe the estimated alphas for the firms sorted against the Debt-to-Equity ratio. The CAPM Jansen's alpha shows that the portfolio of the least leveraged firms underperforms relative to the highly leveraged firms. The spread P10-P1 is 18.61% and is statistically highly significant. The same is observed for the other two time-series models i-e FF3 and FF5. Wald test also rejects the null hypothesis. Similar alphas are observed in the case of the second leverage sorting criteria i-e Total debt to Market Value. The alphas of the least constrained firms are higher than the alphas of the most constrained firms. The spread p10-p1 in the case of CAPM and FF3 is not statistically significant, but in the case of FF5, the spread is statistically significant at 1%. Table 6 reports the time series risk-adjusted performance of portfolios sorted based on the firm's Interest coverage ratio. The table showed the mixed results against Interest Coverage Ratio, the Alphas of CAPM, FF3 both give a positive spread from P10-P1, for CAPM, the spread is statistically significant but at FF3, it is not significant. FF5 gives a negative and insignificant spread.

The Previous asset pricing results, referring to the most sophisticated proxies taken for financial constraints suggest and confirm that the risk-adjusted returns of the most constrained firms give an extra premium to the investors in the Pakistan Stock exchange if we take leverage ratios as proxies of financial constraints. The results are statistically significant also.

Table 2: Descriptive Characteristics of Decile Stock Portfolios constructed on the basis of Total Debt to Common Equity Ratio

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	p10- p1	t-
Least Constrained												
Most Constrained												
EW												
%												-
p. a.	0.26	0.28	0.35	0.26	0.23	0.22	0.21	0.20	0.19	0.24	-0.01	0.17
VW												
%												2.3
p. a.	0.16	0.32	0.28	0.23	0.27	0.26	0.21	0.20	0.27	0.36	0.20	1

MV												
(Rs. m)	542158.42	393970.73	370306.71	293983.45	219650.27	186807.84	196849.19	236353.01	168685.22	154475.66	387682.76	16.03
CAPM												
Beta	0.25	0.25	0.26	0.24	0.24	0.37	0.24	0.31	0.19	0.47	0.22	1.83

Table 2 reports the descriptive characteristics of the portfolios constructed on the first FC constraint Total debt to book value of common equity Ratio as being set as the sorting criteria to make decile portfolios. The P1 has shares of the firms listed on the Pakistan Stock Exchange with the least Financial Constraint having the lowest debt to equity ratio and P10 is the Portfolio having firms with the highest debt to common equity ratio as being the most financially constrained. The EW and VW portfolio returns are the post-ranking average annualized returns (t + 1) calculated in excess of their risk-free rate. The spread P10 – P1 is calculated by taking the difference between the most FC portfolio returns and the least FC portfolio returns. The CAPM beta in the last line of the table showed the systematic risk of the portfolio. The last column reports the t-values where the Null Hypothesis is “There is no difference between the means of P 10 and P1 portfolio’s Characteristics”, and the alternative hypothesis is Vice Versa.

Table 3: Descriptive Characteristics of Decile Stock Portfolios Constructed based on Total Debt to Total Market Value ratio

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	p10-p1	t-value
Least Constrained												
Most Constrained												
EW %												
p. a.	0.28	0.24	0.21	0.27	0.18	0.20	0.21	0.24	0.26	0.31	0.03	0.35
VW %												
p. a.	0.27	0.25	0.20	0.30	0.18	0.25	0.29	0.32	0.33	0.34	0.08	0.63
MV (Rs.m)	761757.15	494250.52	515970.07	239381.82	264669.61	176016.91	155611.69	77215.22	40962.98	20398.98	741358.18	-20.33
CAPM beta	0.27	0.17	0.17	0.24	0.28	0.34	0.25	0.40	0.34	0.39	0.12	-1.92

The table 3 reports the descriptive characteristics of the portfolios constructed on the second FC constraint Total Debt to Market Value Ratio as being set the sorting criteria to make decile portfolios. The P1 has shares of the firms listed in the Pakistan Stock Exchange with the least Financial Constraint having the lowest values of the Debt to Market Value Ratio and P10 is the Portfolio of those firms listed in PSX having the highest Debt to Total Market Value are most financially constrained. The EW and VW portfolio retruns are the post ranking average annualized returns (t + 1) calculated in excess of their risk-free rate. The spread P10 – P1 is calculated by taking the difference between the most FC portfolio returns and the least FC portfolio returns. The CAPM beta in the last line of the table showed the systematic risk of the portfolio, the last column shows the t-Values against the Null Hypothesis that “there is no difference in means of the portfolios of P10 and P1”.

Table 4: Descriptive Characteristics of Decile Portfolios Constructed based on Interest Coverage Ratio

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	p10-p1	t-
Least Constrained												
Most Constrained												
EW %												
p. a.	0.17	0.15	0.15	0.15	0.24	0.32	0.28	0.27	0.32	0.29	0.12	1.61
VW %												
p. a.	0.19	0.13	0.21	0.17	0.26	0.26	0.29	0.26	0.27	0.26	0.08	0.81
MV (Rs.m)	54252.77	63249.42	62000.31	101442.44	156768.70	207461.56	282516.28	338112.99	442339.09	551217.23	496964.47	16.91
CAPM Beta	0.36	0.33	0.46	0.28	0.28	0.15	0.25	0.22	0.27	0.14	-0.22	2.11

The table reports the descriptive characteristics of the portfolios constructed on the third FC constraint Interest Coverage Ratio (EBIT/ Total interest expense) as being set as the sorting criteria to make decile portfolios at month t for the firms listed on the Pakistan Stock Exchange from 2000 to 2019. The P1 has stocks of the firms listed in the Pakistan Stock Exchange with the least Financial Constraint having the highest values of interest coverage ratio and P10 is the Portfolio

of those firms listed in PSX having the lowest values of interest coverage ratio as most financially constrained. . The EW and VW portfolio returns are the post ranking average annualized returns (t +1) calculated more than their risk-free rate. The spread P10 – P1 is calculated by taking the difference between the most FC portfolio returns and the least FC portfolio returns. The CAPM beta in the last line of the table showed the systematic Risk of the Portfolio, and the t-values reported on the Null Hypothesis: The mean difference between P10 and P1 is Zero.

Table 5: Alphas of Value-Weighted Decile Portfolios based on FC-1 Total Debt to Common Equity Ratio

Value Weighted												
	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	p10-p1	Wald-test
CAPM Alpha	1.02	19.31	16.96	9.75	12.84	14.08	8.62	7.05	14.39	19.63	18.61	61.56
	(0.19)	(3.60)***	(3.60)***	(2.10)*	(2.56)**	(3.16)***	(1.81)*	(1.34)	(2.01)*	(2.35)*	(2.10)**	[0.00]
FF3 Alpha	-4.47	7.22	18.79	7.78	13.96	13.66	6.80	8.15	16.30	18.65	23.12	33.14
	(-.68)	(1.02)	(3.20)***	(1.34)	(2.10)**	(2.45)**	(1.11)	(1.17)	(1.86)*	(1.79)*	(2.12)**	[0.00]
FF3 Alpha	-1.62	7.12	19.03	8.88	18.23	16.84	9.18	14.36	19.93	30.03	34.24	41.04
	(-.22)	(0.95)	(2.86)***	(1.36)	(2.51)**	(2.74)***	(1.31)	(1.90)*	(2.07)**	(2.58)**	(2.69)***	[0.00]

The table shows the alpha values of CAPM, FF3 and FF5 for the decile VW stock retrns portfolios sorted on the basis of Total debt to Common equity ratio. The portfolio consists of the firms listed in PSX for the sample period of 2000 to 2019. The alphas are the abnormal/excess returns known as the abnormal performance of the portfolios. P1 represents the portfolio of the firms having the lowest value of total debt to common equity ratio and P10 represents the portfolio of the firm returns having the highest debt to equity ratio. The spread between P10 and P1 is the difference between P10 and P1 and it is also called the zero-cost strategy, therefore Most FC firms hold a long position in the market, whereas the least FC firms sell short. The annualized estimates of abnormal returns (alphas) are calculated through E-views by using the asset pricing models; CAPM, FF3 and FF5 with their corresponding t-values in the second line inside the parenthesis. The Chi-square statistics gives the Wald test values with their p values in the last column for testing joint significance. The Null Hypothesis tested here can be stated as “ the alphas of decile portfolios are jointly equal to zero. Probability or **P-values** are given under each Chi-square value in parenthesis.

The *** ** * showed the values are significant at 1%, 5% and 10% respectively.

Table 6: Alphas of Value-Weighted Decile Portfolios based on FC2; Total Debt to Market Value Ratio

Value Weighted												
	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	p10-p1	Wald-test
CAPM Alpha	12.97	13.44	8.49	17.08	6.16	10.98	14.02	15.36	15.90	16.37	3.41	53.61
	(2.23)*	(2.77)**	(1.79)*	(3.42)**	(1.65)*	(2.21)**	(2.68)**	(2.29)**	(1.95)**	(1.47)	(0.26)	[0.00]
FF3 Alpha	-0.06	8.03	7.83	16.24	4.71	13.88	17.51	21.31	21.21	19.40	19.46	35.34
	(-0.01)	(1.37)	(1.29)	(2.53)**	(0.98)	(2.23)**	(2.54)**	(2.62)**	(2.06)**	(1.40)	(1.18)	[0.00]
FF3 Alpha	-0.31	4.21	9.38	17.75	6.37	19.73	24.30	28.48	33.32	33.49	34.03	52.91
	(-0.04)	(0.63)	(1.40)	(2.50)**	(1.19)	(3.00)**	(3.18)**	(3.08)**	(3.06)**	(2.22)*	(2.13)*	[0.00]

The table shows the alpha values of CAPM, FF3 and FF5 for the decile VW stock returns portfolios sorted based on the Total debt to market value ratio. The portfolio consists of the firms listed in PSX for the sample period of 2000 to 2019. The alphas are the abnormal/excess returns known as the abnormal performance of the portfolios. P1 represents the portfolio of the firms having the lowest value of total debt to market value ratio and P10 represents the portfolio of the firm returns having the highest debt to market value ratio. The spread between P10 and P1 is the difference between P10 and P1 and it is also called a zero-cost strategy, therefore Most FC firms hold a long position in the market, whereas the least FC firms sell short. The annualized estimates of abnormal returns (alphas) are calculated through E-views by using the asset pricing models; CAPM, FF3 and FF5 with their corresponding t-values in the second line inside the parenthesis. The Chi-square statistics gives the Wald test values with their p values in the last column for testing joint significance. The Null Hypothesis tested here can be stated as “ the alphas of decile portfolios are jointly equal to zero. Probability or **P-values** are given under each Chi-square value in parenthesis.

The *** ** * showed the values are significant at 1%, 5% and 10% respectively.

Table 7: Alphas of Value-Weighted Decile Portfolios based on FC6; Interest Coverage Ratio i-e EBIT/ Interest Expense

Value Weighted												
	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	p10-p1	Wald-test
CAPM	0.55	-2.86	5.04	1.87	12.92	14.09	16.72	12.90	15.98	14.38	13.83	53.83
Alpha	(0.07)	(-0.39)	(0.70)	(0.32)	(2.15)**	(2.60)**	(3.56)***	(2.81)***	(3.35)***	(3.15)***	(1.46)	[0.00]
FF3	0.27	3.87	2.74	6.01	18.22	13.40	14.71	12.31	13.34	10.29	10.03	29.10
Alpha	(0.03)	(0.42)	(0.30)	(0.83)	(2.31)**	(1.89)*	(2.51)**	(2.20)**	(2.17)**	(1.84)**	(0.87)	[0.00]
FF5	14.17	15.77	10.66	11.79	26.18	15.66	17.43	12.08	14.48	7.54	-6.63	37.71
Alpha	(1.35)	(1.56)	(1.03)	(1.50)	(3.10)***	(1.91)*	(2.67)***	(1.92)*	(2.14)**	(1.21)	(0.52)	[0.00]

The table 7 shows the alpha values of CAPM, FF3 and FF5 for the decile VW stock returns portfolios sorted on the basis of Interest coverage ratio. The portfolio consists of the firms listed in PSX for the sample period of 2000 to 2019. The alphas are the abnormal/excess returns known as the abnormal performance of the portfolios. P1 represents the portfolio of the firms having the lowest value of interest coverage and P10 represents the portfolio of the firm's returns having the highest interest coverage ratio. The spread between P10 and P1 is the difference between P10 and P1 and it is also called the zero-cost strategy, therefore Most FC firms hold a long position in the market, whereas the least FC firms sell short. The annualized estimates of abnormal returns (alphas) are calculated through E-views by using the asset pricing models; CAPM, FF3 and FF5 with their corresponding t-values in the second line inside the parenthesis. The Chi-square statistics gives the Wald test values with their p values in the last column for testing joint significance. The Null Hypothesis tested here can be stated "the alphas of decile portfolios are jointly equal to zero. Probability or **P-values** are given under each Chi-square value in parenthesis.

The *** ** * showed the values are significant at 1%, 5% and 10% respectively.

DISCUSSION

This study is the first of its kind that examines the reaction of the stock return of the most and the least financially constrained firms listed on the Pakistan stock exchange taking three financial constraint proxies and using a sample period of 19 years from January 2000 to June 2019. The criteria or proxies of financial constraints that have been used to measure the degree of financial constraints for each firm listed on the Pakistan Stock exchange; these proxies used information embedded into the assets and liabilities side of the firm's balance sheets as well as in their cash flows. Specifically, the following measures have been used: Firm size proxied by the book value of its assets, debt capacity of the firms by Tangible to total assets, and cash holdings to total assets (Balafas & Kostakis, 2015).

1. The key finding of this study is that investors are mostly being compensated on Pakistan Stock Exchange if they are investing in FC firms sorted on the basis of leverage ratios. The investors do get a premium in the Pakistan stock exchange if they invest in high leveraged firms with having high Total debt to common equity ratio. The investors can take a long position if they are having the stocks of the firms having high Total debt to common equity ratio. The abnormal returns against Jansen's alpha and the alpha values of FF3 and FF5 are also positive and statistically significant, which means that these asset pricing models don't account for these abnormal returns and the investors get a premium if they invest in the most financially constrained firms of Pakistan sorted based on Total debt to common equity ratio.
2. Recent studies in finance revealed that the stock price behavior is inconsistent with the prediction of familiar models like CAPM, Fama French three-factor, Carhart four-factor, and Fama French five-factor models. The time-series research itself is evidence that the expected returns are not constant through time. Some of the temporal patterns in returns, particularly those related to calendar turning points are quite disturbing as they defy any economic theory and its interpretations. Similarly, the cross-sectional study on different anomalies also poses a significant challenge to the well-established asset pricing paradigm. Yet mounting evidence, there is little consensus among researchers over alternative asset pricing models. Therefore, the focus of future research should be focused on the development of new models. One of the recent contributions to this line of research is the recognition of potential sources of risk (for example; the risk related to financial distress) and also the recognition of risk through behavioral finance research. More importantly, the researchers must recognize that the existence of anomalies does not mean that the asset pricing models are wrong; that anomalous behavior can be an issue of data snooping. So, it is possible that the empirical research that we are doing on different anomalies can give similar results when done by other researchers in the future with the same data and in the same market. And although many of these effects have persisted for nearly 100 years, there is no guarantee of their persistence in the future. So, more research is necessary to resolve this issue.

3. The capital and money markets in Pakistan are under a lot of pressure and stress due to COVID-19. And this phenomenon is quite evident from the market capitalization and its daily turnover. The global markets are also highly affected by this. Hence, this research is highly important in this era as the firms that are already financially very constrained became more constrained due to this virus and the shutting down of businesses and markets. So future research can be done on the impact of the COVID-19 wave on the financially constrained firms of Pakistan to devise a solution to overcome their problem.

CONCLUSION

The outcomes of this study indicate positive results (e.g. higher returns) are observed when the capital structure of the FC firms is heavy with debt as compared to unconstrained firms in PSX. In addition, the time series outcome shows that risk-adjusted returns of most FC firms give an extra premium to investors in the PSX when leverage ratios are used as proxies of financial constraints.

The study is important for academicians as well as it has practical significance for the investors working in the Pakistan stock exchange and other stakeholders

1. As it is conducted in Pakistan, it can be generalized to similar economies and countries. For academicians, the study enriches the literature as it is unique in its context and methodology. There is no evidence present in previous studies, where the firms listed in the Pakistan Stock Exchange are sorted based on FC and unconstrained firms. The devised methodology also results in a more refined and accurate quality of analyses and findings and a more comprehensive and sound knowledge of asset pricing as compared to previously conducted studies in PSX.
2. To the investor:
 - a. The findings and conclusion of this study enhance the economic decision-making of investors to ensure maximum returns in the Pakistan equity market and similar emerging and frontier markets in the region.
 - b. At the same time, the investor can also decide about their position in the stock exchange. They can choose to take a “long” or “short” position (buy or sell the stocks) accordingly. If the firm is financially constrained and is not offering higher returns or premiums for bearing extra risk; then the investor can take a short position and may change that stock in his portfolio with the other stock of the least financially constrained firm and vice versa.
3. To the Government and Regulatory Institutions: The study is helpful for government regulators in devising a regulatory framework that specifically caters for the needs of creditors. The financial institutions can also design and frame their policies to ensure credit facilitation in the Pakistani market. The Security and Exchange Commission of Pakistan (SECP) can utilize this research to design market structures and trading mechanisms to account for low market capitalization and the lack of market depth and breadth as the equity market in Pakistan is very small having only 516 companies listed as compared to UK and USA market where 9000 and 5000 companies are listed simultaneously.
4. To the corporate sector: The study findings facilitate the companies listed in PSX to gauge their financial/ cost of capital risk, which is more closely related to investors’ perceptions of risk and return in the equity market.
5. In the domain of finance: The present study provides a literature contribution to finance as well as it can be used to make an augmented model of asset pricing specifically for emerging markets by taking the FC factor as one of the main contributing risk factors to predict returns in the equity market.

LIMITATIONS AND FUTURE RESEARCH

By accounting for financial constraints, this study used an augmented model of asset pricing tailored for emerging and frontier financial markets. Future researchers, however, may choose to use other CAPM approaches, such as the Behavioral Assets Pricing Model (BAPM), Inter-temporal Capital Asset Pricing Model (I-CAPM), and Downside Capital Asset Pricing Model (D-CAPM), to investigate the effect of CAPM on investment decisions. Future research may compare the CCAPM model to other models in addition to using the same model (BAPM, DCAPM, or ICAPM).

CONFLICT OF INTEREST AND ETHICAL STANDARDS

It is clarified that there exists no conflict of interest with any organization and it is assured that no unethical practices have been followed during the study

AUTHORS’ CONTRIBUTIONS

Musarrat Karamat: Data Analysis and its interpretation, Abstract, Introduction and Conclusion writing, review of the article after completion, and correspondence with the journal.

Sultan Salahuddin: Data Collection, working on Literature and after completion of research, its review.

Aisha Javaid: Data Collection, working on Literature and after completion of research, its review.

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