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Default Risk Pricing – An evidence from Pakistan

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Abstract

This study aims to estimate the default risk and its pricing implications in Pakistan, where an effort has been made to use a sophisticated model, i.e., Logit based hazard model by Campbell (2011) to estimate default, as the majority of literature available in Pakistan is based on accounting models and lack pricing implications on equity. The study covers data from the 2000-2019 period using all listed companies on Pakistan Stock Exchange. It uses decile portfolios sorted on default risk to understand the time series implication of CAPM, Fama-French Three Factor and Five Factor Models on the default risk pricing of equities. The results suggest that default risk is a significant sorting criterion for portfolios, and Fama French Five Model significantly captures the risk premium in equally weighted portfolios. Still, value-weighted portfolios do not show premium earnings rather reflect negative alpha's across decile portfolios. Thus, the results are significant for portfolio managers and diversified investors in devising the portfolio and investment strategies.

Keywords: *Default Risk, Equity Pricing, Logit Models, Equity Pricing*

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INTRODUCTION

The default risk has remained a prime concern for investors as the relationship identified in terms of the risk and return calls for higher equity premiums by investors due to increased financial risk, as identified by Campbell et al. (2008). Interest in the subject area also increased manifold due to regulators and creditors' involvement to maintain discipline in the financial markets and providing confidence to financial institutions operating in the sector. The focus in the subject area can be traced back to Bachelier (1900) work on fluctuation in financial assets prices and later in the works of Markowitz (1952), (Sharpe, 1964), Black & Scholes (1973), Merton (1973), Altman (1973), Altman & Loris (1976), Altman & McGough (1974) and Altman, Haldeman, & Narayanan (1977), Ohlson (1980) and so on, who extended the evidence of fluctuations in asset prices and associated it with risk and introduced various measures of risk to explain the fluctuations and financial performance of firms. If we trace the default risk and related asset pricing work in Pakistan, we can see the effort is quite dismal as the majority of the work is centred around Z–score model to forecast and analyse default in Pakistan. The literature includes study by Rashid (2011), who in his work proposed a local version of Z-Score Model in the context of Pakistan, while default risk was assessed as Systematic Risk by Shahzad Ijaz et al. (2013) and Malik et al. (2013) in Pakistan. Chhapra et al. (2020) in their study also employed accounting factors based Ohlson (1980) model to estimate O-Score for assessing the default and used it in portfolio based analysis of equity returns. They employed a commonly used methodology in this context of testing the Capital Assets Pricing Model i.e. Fama-French methodology, to appreciate the pricing implications of Default Risk in the context Karachi Stock Exchange and is among some of the notable empirical works available in the backdrop of Pakistan for understanding default risk premia. Results in their studies are as per empirical evidence reported in classical risk-return theory i.e. highly distressed firms exhibited superior return earnings. Apart from these studies, evidence by Qayyum & Suh (2019) and Akhtar et al. (2018) based on Z-score is also available to propose the determinants of bankruptcy in Pakistan without making any effort to either assess the pricing implications or redefine the default risk on the basis of their findings. Qayyum & Suh (2019) conversely used portfolio to report negative risk and returns relationship in equities and was robust to classical Z-Score and Merton’s Distance to Default estimates. Among international evidence related to accounting models, Dichev (1998) work is considered an important contribution to the distress risk as a pricing factor along with size and book-to-market factors. He used Altman (1968) and Ohlson (1980) measures of distress as a benchmark for estimating default to test the association between default risk and return using decile portfolios and the regression analysis. Dichev (1998) reported high default portfolios netting unusually lower returns in contradiction of the customary understanding of risk returns relationship; he concludes such anomalous results are due to mispricing of assets in the market as firms with low returns were having higher default risk.

However, due to methodological and theoretical issues with accounting models, the next line of default risk and related asset pricing models presented are Structural Default models, which are robust compared to accounting models. However, the related research following structural models is also inadequate in Pakistan’s financial market and revolves around Merton (1973) and KMV-Merton employed by KMV Corporation, later acquired by Moody's. This effort includes a paper by Elahi et al. (2014) which applied the KMV-Merton methodology in the context of Pakistan.

Due to the static nature of Structural Models, where default risk is estimated at one point of time against the dynamic nature of this risk, later studies focused on handling this issue with pioneering work on Dynamic or Hazard Models such as Shumway (2001). As such only two studies are traced based on dynamic models i.e. Khan, Iqbal, and Iftikhar (2020) research in the context of Pakistan, used a dynamic probit regression and hybrid artificial neural network model following Merton (1974) to test bankruptcy estimates. Khan & Iqbal (2021) also reported asset pricing results using default risk estimates from their earlier study, where the default risk was considered an important consideration in asset pricing while testing the Fama-French Five Factor assets pricing model and they also reported evidence of mispricing in PSX in this context. In our study, we have followed the Campbell et al. (2011) with modification in Shumway (2001), to forecast the probability of default to estimate risk associated with default; motivated by need to use a robust model for asset pricing in Pakistan, due to the reason of almost non-existent research in the area using sophisticated models. Our study incorporates 20-years data for all registered firms in PSX-100 following the Campbell et al. (2011) methodology using monthly data. Our work has focused on two aspects in this study 1) if there is any return differential possible using default risk sorted portfolios by investors and 2) are we able to capture abnormal returns using the three generally used asset-pricing models i.e. CAPM, Fama-French (1993) three-factor model and Fama-French (2015) five factor model.

LITERATURE REVIEW

In the context of default risk, there is a dearth of work on default risk in general and asset pricing in particular, identifying a gap in this area in Pakistan. The evidence presented internationally for default risk suggests it as one of the asset pricing anomalies identified by Vassalou & Xing (2004) study among pioneering works in the area. As per their reported results, a close relationship among the size and book-to-market (B/M) value factors is present, while they also report small firms returning higher returns as compared to the big size firms, subject to such firms having high default risk, apart from having high B/M ratio. They also reported evidence of default risk being a systematic risk using the common asset pricing test i.e. Fama & French (1993) methodology and reported by Malik et. al. (2013) in the context of Pakistan as well. They also suggest presence of some infomation in such firm related characteristics which also influences equity prices. However, their work fails to report evidence on size and B/M factors associated with default risk per se, and as per their inference, it is a separate and important factor to consider in asset pricing models.

In line with Vassalou & Xing (2004) approach, Da & Gao (2010) also tested similar problem by employing a comparable data set for the identical time period and used six months returns prior to default relative to the one-month equity returns used in benchmark study. With these marked changes in return for default estimation, they also reported a positive relationship among default risk in the first month following the event when the firm faces default risk shock. After the default related distress, the divergence among the returns of firms with high default risk and lower default risk declines to negligible levels. They relate this returns behaviour of high default risk firm's with clientele effect i.e. clients switching from one firm to other, as the institutional stockholders disinvest from inferior and risky to investments to superior and safe equities in order to sustain and increase the investment value of their investors. This activity causes a liquidity shock for firms having default risk, as the investors dump these stocks due to high default risk, thus relating their findings with the liquidity shock phenomenon as suggested by Vassalou & Xing (2004). The implication is also important as Pakistan having less developed financial markets, low savings and low per capita stock market investments may reflect such returns patterns apart from high institutional participation in equity markets, which may also cause liquidity shock.

Another important study, using multiple default risk estimates by Chava & Purnandam (2010) is on assessing the association among equity premium and default risk in order to understand its pricing implications. They report their results related to distressed equities due to default risk to have performed poorly, in line with results documented by Campbell, Hilscher, & Szilagui (2008). While Sudheer & Amiyatosh (2010) research study to explore default risk implications as anomalous i.e. influencing equity premiums contrary to the findings documented by a number of empirical studies including Elton (1999) and Campbell et al. (2008). They present negative association between risk premium and default, in contrast to the theoretical and classical evidence of positive association. They, while using Merton (1973) model have also used Hazard models as suggested by Shumway (2001), Chava & Jarrow (2004) and Campbell et al. (2008) to find the default risk and justify their findings of negative association of risk and returns with market inefficiencies. They also cite Elton (1999) findings related to short sample periods as the reason of failure in capturing the default risk or any other shock, which may have significant pricing information, as it might be neutralizing default related impact.

In contrast, Lundblad (2006) presents his evidence based on broad and extended periods using a sample of actual returns to record the positive relationship between risk and return. They conclude that the issue is critical due to the construction dynamics of sample portfolios with default, as the average stock in the sample portfolios is highly likely to default. In contrast, positive returns in a portfolio is only possible if some stocks net a very high level of positive returns. They report a very strong cross-sectional relationship in the assessment of the default risk and equity return. However, the long-term association among default risk and equity returns is found to be in line with Campbell et al. (2008) i.e., low in the post-1980 period of their 1952-2006 sample, while the underperformance decreased significantly for the total sample. On the issue of default risk as an anomaly Sudheer & Amiyatosh (2010) perspective is contrary to the many of the empirical findings as they understand it as a case of low realized returns rather than anomaly.

Friewald et al. (2012) used a unique methodology from the perspective of linking equity with credit markets, using Merton (1973) structural model framework to estimate credit risk premium. The credit risk premium for each firm were estimated using the CDS forward curve based on Cochrane & Monika (2005) approach. They report a significant and positive relationship between credit risk premium and excess equity returns. This is in line with evidence reported by Sudheer & Amiyatosh (2010), where default risk based on Merton (1973) and Shumway (2001) methodology captured the pricing information, apart from Vassalou & Xing (2004), who also reported the pricing information being captured by the Merton (1973) measure of default risk.

Garlappi & Yan (2011) work is based on assessing the default risk and related equity returns following a simplified version of KMV model in line with Bharath & Shumway (2004) approach, which is an extension of Merton (1973). The major objective of their study is on challenging the anomalous pattern of earnings under the influence of default risk as a pricing factor reported in the empirical literature. They report a hump-shaped curve between equity betas and stock returns with default probabilities, due to their model having a shareholder's recovery feature. This finding explains the negative relationship between the stock returns and default risk, in line with Campbell et al. (2008) and George & Hwang (2010) conclusion. The results were also robust with a refined version of Jegadeesh & Sheridan (1993) momentum profits. However, in case of Pakistan, while using this KMV model, this study faced data issues in forming portfolios resulting in inability to assess pricing implications, further resulting in inability to assess the robustness of default risk measures based on Campbell et al., (2011).

Therefore, based on the mixed results, which in some instances confirm the classical risk-return relationship, in some cases report the anomalous result of low return against the high risk and negative returns makes it an interesting problem to explore in the case of Pakistan, which marks one of the emerging equity markets with low investment profiles among general investors, corporate governance issues causing low investor confidence and relate the firm performance with it (Akbar et al., 2019). Due to the reason this study uses Campbell et al., (2011) to test the asset pricing model and ability to earn excess return based on such portfolios.

METHODOLOGY

For the purpose of estimating the default risk, a Hazard Model used by Campbell et al. (2011) has been employed in this study. The model is based on logit estimates in the following form:

$$\Pr_{t-1}(D_{it}=1)=\frac{1}{1+\exp(-\alpha-\beta v_{i,t-1})} \qquad \text{(i)}$$

Where:

Dit Default is used as the dependent variable of the model and is a binary variable, identifying firms facing default or are termed as fail. As per our operational definition of this study, if as firm has been suspended for trading under PSX listing regulations clause 5.11.1 (b) firm has adjourned commercial production/business operations in its principle line of business, 5.11.1 (c) non-holding of annual general meetings, 5.11.1 (d) not submitted the audited accounts, 5.11.1 (e) inability to pay its listing fee/PSX dues, (g) CDC eligibility suspended by CDC, 5.11.1 (i) auditors have issued an adverse audit report with comments showing a grim future, 5.11.1 (l) winding up notice has been served/proceedings have been initiated by the SECP or 5.11.1 (m) petition has been filed by creditors for winding/winding-up orders passed by the court of law and liquidators assigned subsequently, and SECP listing of delisted firms in the month 't' and,

Vi, t-1 represents a vector of independent variables consisting of accounting and market ratios. While following accounting and market ratios are used in the model as independent variables:

Returns on Assets: The ratio is computed using the Net Income of the past year and the market value of total assets, where this ratio is further refined by the Campbell et al., (2011) by using the sum of the market value of equity and debt as a better proxy of the market value of assets, thus renaming the ratio as Net Income to Total Market Value of Assets (NIMTA).

Leverage Ratio: For the purpose of estimating the leverage ratio in this study, a ratio of total liabilities to the total market value of assets is calculated, where the market value of total assets is measured in a similar way as used in NIMTA, and the leverage ratio is titled Total Liabilities to Total Market Value of Assets (TLMTA). Short Term Liquidity Ratio: Short-term liquidity of the firm is measured through the ratio of Cash to Total Market Value of Total Value of Assets (CASHMTA), where the market value of assets is used in the same fashion in NIMTA and TLMTA.

Firm Size: The firm size is measured in relative terms by computing a ratio of the firm's equity relative to the Pakistan Stock Exchange (PSX) 100 index market value or capitalization, named now RSIZE.

Return on Equity: The market's reaction to a firm's default risk is measured through Return on Equity by employing the excess returns on equity ratio of the firm relative to PSX all index in the following functional form:

$$EXRET_{it} = \log(1 + R_{it}) - \log(1 + R_{PSX\ All})$$

Volatility: As suggested by Campbell et al., (2011), this variable is used to capture the distressed firm's returns volatility as compared to the returns pattern of a stable firm and has been represented with SIGMA and is estimated by the standard deviation of stocks returns over the past three month's time period, in the following functional form:

$$SIGMA_{i,t-1,t-3} = \left(252 * \frac{1}{N-1} \sum_{k \in \{t-1,t-2,t-3\}} r_{i,k}^2 \right)^{\frac{1}{2}}$$

Market to Book Value: The ratio between the market value of a firm's equity and the book value of the firm's equity has been used to measure the overvaluation of the distressed stocks, which are expected to have faced heavy losses in the near past. Campbell et al. (2011) have used this ratio as an adjustment factor against the model's initial three factors, i.e., accounting ratios.

Stock Price: As the distressed stock's prices are expected to be low, the factor has been used to capture another factor representing distressed firms. As such, the factor in the original study has been highly significant in predicting the default risk model.

In order to assess the default risk pricing, the analysis has been carried out based on using portfolio analysis by constructing decile portfolios based on default probabilities. Further, we have used the time series regression recommended by Black & Scholes (1973), as the slopes estimated using the time-series regression provide the evidence of risk being captured by the performance of stock returns. We are using the traditionally used CAPM, Fama-French Three Factor Model and Five models to compare the performance of distressed stocks. The specification of the three assets pricing models is as given in equations (ii), (iiii) and (iv) below:

$$K_{i,t} - K_t^f = \alpha + \beta_{i,M}(K_{m,t} - K_t^f) + \varepsilon_{i,t} \quad (ii)$$

$$K_{i,t} - K_{rf,t} = \alpha_i + \beta_{i,m}(K_{m,t} - K_{rf,t}) + \beta_{SMB}(SMB) + \beta_{HML}(HML) + \varepsilon_{i,t} \quad (iii)$$

$$K_{i,t} - K_{rf,t} = \alpha_i + \beta_{i,m}(K_{m,t} - K_{rf,t}) + \beta_{SMB}(SMB) + \beta_{HML}(HML) + \beta_{RMW}(RMW) + \beta_{CMA}(CMA) + \varepsilon_{i,t} \quad (iv)$$

In order to handle the assumptions of multivariate normality, we have used the Generalised Method of Moments (GMM) in estimating the alpha's of three models, as it requires the particular model to be specified without the specification of a particular distribution.

Analysis:
Initially, we are starting the analysis with preliminary descriptive statistics as presented in Table-I as follows:

Table – I : Descriptive Analysis

Variables	Return	ExRet*	ExRet	NIMTA	TLMTA	CASHMTA	RSIZE	SIGMA	LogP
Min	(0.95)	(1.08)	(1.38)	(43.42)	0.19	5.36	5.79	0.00	(3.00)
Max	33.00	32.94	1.53	268.31	704.98	36.31	7.48	30.31	4.18
Average	0.02	(0.07)	(0.01)	0.49	0.98	0.97	2.17	1.93	1.39

Standard Deviation	0.238	0.242	0.074	5.984	3.574	9.682	1.215	3.249	0.787
Criteria	<0.05	<0.1	<0.05	<0.1	>0.45	<0.05	<0.05	>1.5	<1
%	0.717	0.897	0.87	0.572	0.959	0.390	0.962	0.463	0.309

The descriptive statistics are based on data from 352 firms out of 902 listed firms from 2000 to 2019 and 57960 firm months. The returns of the sample firms ranged from negative 0.95% to 33%, with a standard deviation of 0.238 and average returns of 0.02%, showing the majority of firms experience low returns in the default sample. Excess returns used in the model represented by ExReturn* were between negative 1.08% to 32.94%, with a standard deviation of 0.242. In comparison, NIMTA ranged between negative 43.42% to 268.31% and a low standard deviation of 0.058, TLMTA ranged between 0.19% to 704.98% , CASHMTA ranged between 5.36% to 36.31 %, SIGMA ranged between 0.001 to 3031 while stock price (LogP) ranged between -3.0 to 4.18. The analysis confirms the major firm-level characteristics of distressed firms, showing that most firms had low returns, excess returns, profitability, short-term liquidity, and stock market values against the high leverage and volatility in stock prices.

Table-2 **Full Sample Characteristics of Decile Portfolios: 2000-2019**

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	t - value
EW	(0.74)	(0.78)	(0.71)	(0.76)	0.80	(0.71)	0.73	0.70	0.74	(0.49)	0.24	2.73*
VW	(0.79)	0.89	(0.92)	0.85	(0.89)	(0.89)	(0.82)	0.90	(0.85)	(0.72)	0.07	0.89
market Value (Rs.)	4.445	3.052	2.812	2.817	2.494	2.339	2.558	1.691	1.706	0.888	-3.556	-11.57
CAPM Beta	(0.03)	(0.03)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)	(0.05)	(0.02)	(9.18)

Table-2 shows the decile portfolio characteristics sorted on default probabilities for January 2000 to December 2019.

The entire sample of shares listed on the Pakistan Stock Exchange is arranged in ascending order at month (t) based on Default risk Probabilities and is divided into ten portfolios (P1 to P10). Probability values are estimated using Campbel et al. (2011) methodology based on logistic regression. Here, the portfolio titled P1 represents portfolio-containing stocks having lowermost estimated Default risk Probability and the portfolio titled P10 consists of stocks having uppermost estimated Default risk Probability. At the t+1 month, the excess returns of the ten portfolios are estimated to have returns after ranking the stocks, and each of the portfolios has been rebalanced each month. P10-P1 represents the spread amongst portfolios having highest default risk Probability (P10) and lowest Default Probability portfolio (P1). EW and VW represent annualized average monthly returns (% p.a.) of the ten portfolios constructed using the equally weighted and weighted returns, respectively. Market Value (MV) (Rs.tn) represents the average market value of shares in every ten portfolios. In contrast, CAPM Beta represents the beta estimate of the complete sample of value-weighted returns of the ten portfolio's returns. T-Value represents the estimated Wald test value about the null hypothesis in the model that there is no difference in means among the characteristics of highest risk (P10) and lowest risk portfolio (P1).

The P1 in Table-2 represents the lowest risk portfolio as against the P10 which represents the highest risk portfolio, while the Table-2 shows the characteristics of decile portfolios. The equally weighted portfolio returns across all the portfolios are not reflecting any pattern. Still, the P1 shows negative returns against the P10 with low negative returns of 0.49% with a t-statistic of 2.72 on hedge portfolio P10-P1, which is statistically significant. While hedge portfolio returns results show that the return is reduced from lowest to highest risk portfolios and is not as per the mean-variance model, i.e., high risk-high return and low risk-low returns. The abnormal returns against the mean-variance model or theory are justified by Dichev and Piotroski (2001) as investors' under reaction to the default-related information content.

In contrast, the under or overreaction is related to overall information asymmetry in the market. It's also associated with the price inertia theory by Dichev and Piotroski (2001), which asserts that the financial market slowly converges to the intrinsic value depending on the sign of the new information, i.e., same or opposite, resulting in under or over-reaction. The negative returns are also consistent with Banz (1981), Basu (1983), Bhandari (1988), Fama and French (1992, 2004, 2014), Dempsey (2013), Chhapra et al. (2020) due to the failure of CAPM in capturing risk premium. We in Pakistan's context may associate the phenomenon with information asymmetry as well, as the fact is well documented in empirical research.

Table-3: Alpha of VW portfolios

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	Wald Test
Jansen Alpha	(7.47)	(8.72)	(8.85)	(8.45)	(8.61)	(8.59)	(8.11)	(8.57)	(8.38)	(7.24)	0.23	23.84
	(13.8)*	(16.2)*	(16.4)*	(15.6)*	(16.0)*	(15.9)*	(15.0)*	(15.9)*	(15.5)*	(13.4)*	(0.43)	[0.00]
FF-3F Alpha	(4.42)	(5.96)	(5.43)	(4.91)	(5.54)	(4.48)	(4.91)	(5.38)	(5.82)	(3.97)	4.50	64.32
	(6.92)*	(9.34)*	(-8.50)*	(7.69)*	(8.68)*	(7.01)*	(7.69)*	(-.43)*	(9.12)*	(6.22)*	(0.71)	[0.00]
FF-5F Alpha	(4.53)	(5.98)	(5.57)	(4.93)	(5.49)	(4.43)	(4.73)	(5.35)	(5.87)	(3.74)	7.91	76.58
	(7.7)*	(10.2)*	(9.5)*	(8.4)*	(9.4)*	(7.5)*	(8.1)*	(9.1)*	(10.0)*	(6.4)*	(1.35)	[0.00]

The above table reports the risk-adjusted results of the portfolios constructed based on value-weighted returns. The sample includes the data of all firms listed on the PSX between January 2000 till December 2019. It is sorted in increasing pattern at month (t) to estimate Default Probabilities based on 60-month rolling window data, and each portfolio is rebalanced each month. The portfolio (P1) represents stocks containing the lowermost estimates of default risk probability, and the portfolio (P10) represents shares with the higher most estimates of default probability. At the same time, P10-P1 is the spread among the higher most default risk probability portfolio (P10) and lowermost default probability portfolio (P1). Single factor Capital Asset Pricing Model (CAPM) alpha, Fama French Three alpha and Fama French 5 alpha represent annual estimates of alphas based on classical Capital Asset Pricing (CAPM), FF three-factor and FF five-factor models. Parentheses contain the t-statistics values, which indicate the statistical significance of alpha's at 1%. The Wald test results represent the chi-square statistics for the null hypothesis which test wheteher all alphas of ten portfolios are jointly equal to zero. At the same time, their p-values are shown below in square brackets.

Table-3 presents the alpha's based on value-weighted portfolio returns estimated using time series analysis. The alpha's reported for the three assets pricing models have been estimated using Generalised Methods of Moments (GMM) which retain the consistency in standard errors for non-i.i.d. distributions. The P1 presents the lowest default risk portfolio, and P10 represents the highest risk portfolio alphas. The low risk portfolio returns report the high negative returns of 7.47% as against the high-risk portfolio returns results showing low negative returns, which is also confirmed by portfolio characteristics presented in Table-2. The negative signs of Jansen's Alpha reveals that the portfolio failed to earn the required excess returns against the market risk, which reflects failure in achieving diversification in portfolios. The other remaining results based on Fama French three-factor and five-factor alpha also reflect similar results in value-weighted portfolios. The hedge portfolio alpha is also insignificant across the three alpha's. Joshipura explains the phenomenon as the risk factors not being explained due to low-risk effects, i.e., low-risk assets reflecting higher returns and vice-versa.

Table 4: Alpha of EW portfolios

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	Wald Test
Jansen Alpha	6.56	4.31	7.30	5.23	-0.32	5.39	7.52	-0.91	-5.38	-6.58	-13.14	34.11
	(2.21)**	(1.45)	(2.46)*	(1.76)**	(0.11)	(1.82)**	(2.53)*	(0.31)	(1.81)**	(2.22)*	(4.42)*	[0.00]
FF-3F Alpha	1.27	0.10	4.01	2.87	-0.58	5.04	8.99	-1.20	-2.70	-0.32	-1.59	41.85
	(0.69)	(0.05)	(2.18)**	(1.56)***	(0.31)	(2.75)*	(4.89)*	(0.65)	(1.47)***	(0.17)	(0.86)	[0.00]
FF-5F Alpha	(4.91)	(5.05)	(4.97)	(3.58)	(4.69)	(3.45)	(4.13)	(4.32)	(4.36)	1.67	6.58	519.37
	(8.28)*	(8.51)*	(8.38)*	(6.03)*	(7.90)*	(5.81)*	(6.97)*	(7.27)*	(8.14)*	(2.82)*	(5.46)*	0.00

*The above table reports the risk-adjusted performance of the decile portfolios constructed based on equally weighted returns. The sample includes the data of all firms listed on the PSX between January 2000 till December 2019. It is sorted in increasing pattern at month (t) to estimate Default Probabilities based on 60-month rolling window data, and each portfolio is rebalanced each month. The portfolio (P1) represents stocks containing the lowermost estimates of default risk probability, and the portfolio (P10) represents shares with the higher most estimates of default probability. At the same time, P10-P1 is the spread among the higher most default risk probability portfolio (P10) and lowermost default probability portfolio (P1). Single factor Capital Asset Pricing Model (CAPM) alpha, Fama French Three alpha and Fama French 5 alpha represent annual estimates of alphas based on classical Capital Asset Pricing (CAPM), FF three-factor and FF five-factor models. Parentheses contain the t-statistics values, which indicate the statistical significance of alpha's at 1%. The Wald test results represent the chi-square statistics for the null hypothesis which test wheteher all alphas of ten portfolios are jointly equa*l to zero. At the same time, their p-values are shown below in square brackets.

Table-4 reports the value of Jansen, Fama-French three-factor and five-factor alpha's estimated using the equally weighted portfolio returns following GMM augmented estimation, where OLS estimates retain the consistency in standard errors for non-i.i.d. distributions. The results reveal that the Jansen and Fama French three-factor alpha's do not explain the high-risk portfolios (P10). No premium is being earned on them while low-risk portfolio P1 is earning high positive returns. There is no trend in alpha for the two models. The hedge portfolio reflects the negative alpha's, i.e., no premium on the hedge, which fails the hedging prospects. The positive return on a low-risk portfolio is evidence of reaction, whereas the negative returns on a high-risk portfolio suggest the market's underreaction. Two of the results also point out the information asymmetry as the cause of such returns. These results confirm the Joshipura and Joshipura (2020) as seen in value-weighted portfolio results. However, Fama-French Five Factor-alpha reports a different scenario. The results confirm the risk-return theory with a low-risk portfolio having negative returns against a high-risk portfolio with significant positive returns. The hedge portfolio also reflects a positive alpha, i.e., significant positive excess returns earned on the market. Which is an indication of the five-factor model capturing the default risk to some extent.

CONCLUSION

This paper has tried to contribute to the much-desired need in the default risk-pricing field in Pakistan's equity markets in the presence of a very insignificant contribution to asset pricing field in terms of default risk. While undertaking this research, the motivation is based on previous endeavours largely using accounting models, which raised the need to understand the default risk phenomenon with sophisticated models like Hazard or Dynamic Models used by Campbell et al. (2011). To initiate the discussion about conclusion, the descriptive statistics suggest that the variables used in the model follow the characteristics of distressed stocks apart from portfolio characteristics reflects that the returns do not explain the risk premium associated with default risk sorted decile portfolios but Beta estimates reflect the risk pattern in portfolios. Similarly, the time series analysis reveals that in value-weighted portfolios, negative alpha is against the theory and can not be explained but it is statistically significant at 1%, as against understanding that the risk is not being priced in portfolios due to the negative alpha's in the backdrop of Jansen (1938) findings, as he suggests negative alpha's reflect portfolio's failure to earn what they are expected to earn with a given risk. While in equally weighted portfolios, we notice the mixed alpha's i.e., positive and negative, suggesting the default risk as an anomaly, low-risk portfolios earning high positive returns as compared to high-risk portfolios earning less rather negative returns, thus endorsing it as an anomaly in Pakistan Stock market but the results lack pattern across the portfolio. The arbitrage results also show that the Fama French three-factor model results are insignificant against the five-factor model with significant earning and capturing risk. Thus, we can conclude that the default risk is being priced with at least one model i.e., Fama French Five-Factor model and similar results are confirmed by descriptive statistics. Failure of CAPM and three-factor model is also as per evidence, but the variation is alpha's and negative beta's suggest that adjusted returns are influenced by default risk. The findings reported have special significance in the investment strategy of a diversified investor, which suggests that default risk can be one of the factors for portfolio formation; however, the results and strategies can be further enhanced using economic and specific governance-related factors in the estimation of default risk and pricing apart from the testing structure and neural network models.

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