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Effect of Firms Specific Factors on Probability of Default: A Case of Pakistani Non-Financial Sector

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Abstract: Risk measurement is a very important topic in financial literature. The current study the objective is to empirically examine the effect of firm specific factors on the default risk by using extended data set of all listed Pakistani non-financial firms for period from 1995 to 2021. The finding of study suggest that firms with high level of profitability, Cash Flows, liquidity and growth rate are less risky as compared to firms with lower levels of profitability, liquidity and growth rate. The results also suggest that larger firms are less risky as compared to smaller firms. The study also found that firms with higher level of financial risk are more vulnerable to default because of the greater fixed interest cost.

Keywords: Default Risk, Firm Specific variables, Fixed Effect Model

1.0 Introduction:

Default of firm has been deliberated as major research area in the field of finance from last so many years. A lot of very sophisticated and advanced systems are utilized in today's marketplace for quantifying as well as managing the default risks across several different geographic and institutional settings (BIS, 2000). It has been considered that the default risk plays an immense role in financial theory in various perspectives, especially regarding the capital structure of the firm and asset pricing. Firm default events have caused lot of the potential losses to the stockholders and creditors. However, predicting and determining the defaults in the initial phases could really assist in the minimization of losses by providing initial warnings to the investors. It is really important to figure that the firm specific factors play indeed an important role in terms of management of various types of risk. A number of models have been employed in the prediction of

corporate failures, which include models designed and developed on the basis of accounting data as well as on the basis of market prices (BIS, 2000).

Modigliani and Miller (1958) presented a theory known as capital structure irrelevance theory.This theory was presented with certain assumptions like absence of transaction cost and taxes. According to the theory, firm value has no relationship with its leverage, no matter how much a firm increases its leverage. This capital structure irrelevance theory received too much attention and it provided platform to many researchers for further studies but later on because of criticism there was need to modify the theory. So, modified capital structure relevance theory was again presented by Modigliani & Miller (1963), which states by incorporating the element of tax, trade-off theory emerged as a new vesrion of capital structure. According to capital relevance theory value of firm is affected by the change in capital structure. Additionally, it states that firms can get tax benefit (in the form of tax shield) by using high debts.

It is an important decision for managers to identify suitable sources to borrow and identify the right capital mix. There are several theories presented by researchers to elaborate the decision of borrowing. Trade-off theory was presented by Kraus and Litzenberger (1973) elaborating managers have to balance between cost of distress from debt and tax shield benefit. A high debt level can overcome the benefit of tax shield and can lead a firm to default. There is a need to analyse the factors affecting default risk of the firms over a long period of time because institutions take time to change (Frank & Goyal, 2009). They further argue that capital structure decision is a long term decision and it is reasonable to assume that its effect can be captured keeping in view a long time horizon. It will not be appropriate to suppose that changes in capital structure can be captured immediately or considering short term horizon. So, the objective of this study is to empirically find the effect of firm specific factors on default risk by using extended data set of all listed Pakistani non-financial firms for period from 1995 to 2021.

2.0 Literature Review

2.1 Risk Measurement Models:

Risk measurement is a very important topic in financial literature. There are a lot of risks measures used in finance and the choice of risk measures depends upon the sample characteristics. Esty (1997) proposed the method to use standard deviation of company's returns to measure risk. Saurina and Salas (2002) and Gonzalez and González (2012) have used the ration of the non-performing loan to total loans. Covitz et al. (2004) utilized the yield spread of subordinated debt to measure risk. The volatility of the stock return is being utilized by the Saunders et al. (1990). Marco et al. (2008) has used the value at the risk measure in the estimation of bankruptcy risk. Laeven and Levine (2009) utilized Z-score, measuring extent of the company's stability. A number of structural models have been developed for the purpose of forecasting and measuring the credit risk. Models based on Merton (1974) considered that the corporate liabilities are the basically contingent claim on firm's assets. Another measures of the expected default frequency that has been developed by the Bharath and Shumway (2008) that is also based on Merton (1974) structure distance to the default (DD) model. This study uses Bharath and Shumway (2008) model to calculate expected default probability of Pakistani non-financial sectors firms.

In the following sections of the literature review section, the researcher has presented the effect of firm specific variables on expected default probability.

2.2 Impact of Leverage on Default Risk

The traditional finance perspective supports the notion that creditors are risk aversive and equity holders are risk takers. For example, if a firm goes bankrupted then creditors are in safe position and get the most of the liquated value of firm as compared to the equity holders. Creditors claim is mostly backed by tangible assets and settlement is easier (Vos, *et. al*, 2007). Equity holders are in risky position because they are paid after creditors and there is uncertainty about their cash flows.

In case of financial distress the situation is more favourable to creditors as compared to equity holders. The equity holders demand for high returns because of added risk and prove expensive for companies. Molina (2005) has found significant positive association between financial leverage and corporate default. Based on the trade off theory, the main reason to add debt in capital structure instead of equity is tax saving, so a higher tax rate can motivate firms to finance more by debt but it will increase the financial risk and likelihood of default. Baxter (1967) argued that bankruptcy cost is very vital with respect to optimal capital structure. The author reported that the cost of capital curve has positive relationship with leverage. The curve rises as the leverage increases and decline as amount of risk decreases. The cost of capital increases with the increase in debt to the extent that a corporation's capability to fulfil its debt obligations becomes compromised. The author argued that the benefits of tax savings are eradicated due to risk of failure created by high leverage of the firm.

A study done by Kaplan and Stein (1993) also reported positive relationship between financial leverage and chances of default. Later on Andrade and Kaplan (1998) reported that high debt level in firms was the main cause of financial distress. Companies which having high geared capital structure is having more financial risk. That means the company which uses high percentage of debt financing as compared to equity fund faces more default risk due obligation for payment of more interest (Bal, 2012).

H_1: There is a significant relationship between firm leverage and default risk

2.3 Impact of Firm size on Default Risk

Bunn and Redwood (2003) and Jimenez and Saurina (2004) have found that the small firms are more likely to default. Moreover, in turns, Bernhardsen (2001) and Pain and Vesala (2004) has concluded that the systematic affects of firm size on default is relatively small. In accordance to the Moody's (2004), it has been concluded that the big firms are less likely to default in comparison to the small firms; however, in terms of considering the financial statements, especially, considering the financial ratios, the effect of size benefits declines. Thus, a small firm that has a strong financial ratio needs not to be riskier in comparison to the

large firm. Benito et al (2004) observed a significant positive relationship with the default rates and firm size.

Liedholm (1999) argued that when larger firms are in growth stages they less often fail and usually avoid situations like liquidation or default. According to the author larger firms has less probability of default. There is a no relationship between size of the firm and probability of default according to (Zhang, 2017). Drobetz and Fix (2003) found that leverage of company has positive relationship with size of company which indicates that larger companies have less chances of bankruptcy. The other empirical researches, that includes Wald (1999), Marsh (1982), Booth et al. (2001) have found that the leverage is positive correlated with the size of the firm.

H_2: There is a significant relationship between firm size and default risk

2.4 Impact of Tangibility on Default Risk

Agency theory has suggested that the firms with really high leverage ratio tends to under-invest due to high cost of debt, thus, transferring the wealth away from the debt holders to the equity holders. It has been observed that the more a firm has tangible assets; greater is the ability of the firm to secure the debt. Companies that are unable to adequately provide the collateral values have to pay the high interest rates due high agency costs, or willing of encouraging the investors for the issuance of the equity rather than debt (Scott, 1977). Moreover, tangible assets decrease bankruptcy costs and increase liquation value of the firm.

Furthermore, Wiwattanakantang (1999) has found the direct association between leverage and tangibility which increases the firm chances of default. A negative relationship between tangibility and leverage is reported by (Booth et al., 2001). Bevan and Danbolt (2002) also reported that relationship between leverage and asset tangibility depends upon the type of debt in capital structure. The author has found asset tangibility is higher in firms which have more long-term debt and lower in companies with more short term debt in their structure. Jermias and Yigit (2018) reported there is no significant relationship between leverage and asset tangibility but the results indicated that asset tangibility is related to long term leverage.

H_3: There is a significant relationship between tangibility and default risk.

2.5 Impact of Profitability on Default Risk

Gu (2002) argued that the firms and enterprises which have continuous low profitability have great chances of getting bankrupt. The five major profitability rations used for the proxy of the measurement of company's profitability are turnover ratios which measures the effectiveness and efficiency of the firms. Furthermore, it has been proposed that the profitability ratio revolves around the measurement of firm's performance in terms of effective as well as efficient utilization of assets and adequate management of expenses to produce adequate shareholder's earnings. In accordance with the Eljelly et al. (2001), it has been founded that high effectiveness or efficiency ratio causes high profitability and low risk of getting

bankrupt. Vermuelen (2008) has explored the credit risk at industry level and found negative relationship between industry bankruptcy rate and profitability.

Frank and Goyal (2009) reported the negative relationship between firm's profitability and leverage and hence lower default risk. Adams, Burton and hardwick (2003) concluded that there is significant positive effect of firm's profitability on its credit rating. This means profitable insurance firms have less probability of default. Chen (2004) also found negative relationship between profitability and firms' credit risk. Jermias and Yigit (2018) reported that leverage and profitability of firms is negatively related utilizing the data from Turkish companies.

H_4: There is a significant relationship between firm profitability and default risk.

2.6 Impact of Liquidity on Default Risk

Beaver (1966) has argued that firms with the low liquid assets are highly prone to the bankruptcy. The research has utilized six major ratios for the measurement of company's liquidity. A firm in bad financial condition normally face liquidity crunch. A company facing operating losses usually tends to have low level of current assets. Similarly a company with negative working capital normally faces issues in meeting its short term obligations due to lower level of liquidity (Kariuki, 2013). Vermuelen (2008) has explored the credit risk at industry level and found negative relationship between industry bankruptcy rate and liquidity by using data of firms in Netherland.

Adams, Burton and Hardwick (2003) found that liquidity have positive relationship with credit ratings of companies. Higher credit rating means sound companies and less default risk. The author provides two possible explanations. First it is likely that firms hold more cash when in bad financial position and these firms have neither intention to expand nor good investment opportunities. Another possible situation is that there is positive relationship between idiosyncratic risk and cash flows (Bates et al, 2009). Therefore; firms can reduce cash holdings when idiosyncratic risk decreases. Previous studies such as Bouzouita and Young (1998) and Carson and Scott (1997) reported insurance firms with high liquidity risks are given lower credit ratings. This means firms with high liquidity have lower credit risk due to good paying ability. Zhang (2017) also reported negative relationship between liquidity of firms and default risk. The author used cash ratio as measure of liquidity in this study.

H_5: There is a significant relationship between firm liquidity and default risk

2.7 Impact of Firm Growth on Default Risk

Importance of the growth opportunities cannot be neglected in any case. It has been defined as the opportunity for the firm to invest in the profitable projects. Growth opportunity is measured by annual growth of total assets of the firm. In accordance to the argument by Myers (1977), firms having high leverage ratio tend to undertake activities contrary to debt holder's interest or investment in the risky projects which expropriates the wealth from the debt holders. However, empirical evidence in context of

the similar statement is mixed. For instance, Chung (1993), Rajan and Zingales (1995) and Pescetto (2004) have found a negative relationship between firm growth and default risk whereas, Kester (1986) finds no significant relationship between firm growth and default risk, Booth et al. (2001) has found the existence of the positive relationship between firm growth and default risk. Zhang (2017) found no significant relationship between credit risk and growth of firms. Jermias and Yigit (2018) using the data of Turkish companies reported that leverage and growth opportunities of firm has negative association.

H_6: There is a significant relationship between firm growth and default risk

2.8 Impact of Cash Flows on Default Risk

Cash flows determine the ability of a firm to access markets for funds. It has been considered that firms that have positive cash flows comfortably raise capital from the capital market, whereas, on other hand, firms with the insufficient or negative cash flows are unable to borrow from markets and therefore, face the risk of default (Zeitan, Tian & Keen, 2007). It has also been reported by Koch and Shenoy (1996) that leverage and cash flow tend to be negatively related.

It has been argued that cash flows have the ability to determine the financial status of a firm, then; these can also predict and determine the probability of the firm getting default as proposed by (Scott, 1981). It is interpreted that cash flow of the firm has negative impact on the firm value as result of the conflicts of the interests between managers and shareholders (Jensen, 1986). Jensen (1986) presented that the increased leverage and increase dividends assist in lowering costs of the asymmetric information amongst shareholders and managers.

Gentry, Newbold and Whitford (1985) found that a cash-flow component of firms is vital for classifying failed and no-failed firms. Aziz, Emanuel and Lawson (1988) found that cash flows are a fundamental factor affecting the possibility of default. So, it can be argued that cash flows are a function of firm default risk.

H_7: There is a significant relationship between firm cash flows and default risk

3.0 Methodology:

3.1 Introduction

Research means identification of real life issues and providing their attainable solutions (Adams & Schvaneveldt 1991). Research helps humanity in almost every field of life and real life issues consist of diverse subjects of daily life like education, travelling, public affiliation, business, job or personal life. The basic purpose of research is to identify the real cause of unpleasant circumstances and every study provide systematic, logical and detailed explanation of problems and provide possible solutions to satisfy the under research problem (Ghauri, 1995).

3.2 Model of the Study

The following theoretical model was derived for testing

$$DR_{i,t} = \alpha_{i,t} + \beta_{1\,i,t} FG_{i,t} + \beta_{2\,i,t} ROA_{i,t} + \beta_{3\,i,t} LIQ_{i,t} + \beta_{4\,i,t} CFO_{i,t} + \beta_{5\,i,t} TAN_{i,t} + \beta_{6\,i,t} SIZE_{i,t} + \beta_{7\,i,t} FR_{i,t} + \varepsilon_{i,t}$$

Where
α = constant value
β = beta coefficient
ε = error term
DR = Default Risk
FG = Growth of Firm
ROA = Profitability of firm
LIQ = Liquidity of firm
CFO = Cash Flow from operations
TAN = Asset tangibility of firm
SIZE = Size of firm
FR = Financial risk

3.3 Variables of Study

Dependent variable of study is default risk whereas independent variables are firm specific variables. The following table present the proxies used to represent these variables.

TABLE 1: Measurment of Variables

Variables	Abbreviation	Measurement	Reference
Financial Leverage	FL	Total debt/ Total assets	(Zamri et al., 2013)
Liquidity	Liq	Principal component analysis will be done to form index which represent the liquidity of firm	
Performance (ROA)	ROA	Net income/ Total assets	Lazzem et al., 2017

Asset Tangibility	TAN	Net fixed assets/ Total assets	(Frank & Goyal, 2009; Handoo & Sharma, 2014)
Firm Growth	FG	Annual change in the book value of total assets	(Ali, 2011)
Firm's Size	Size	Log of Total Assets at time t	(Zamri et al., 2013; Handoo & Sharma, 2014; Afza & Rashid, 2014)
Cash Flows	CFO	Cash Flow from Operations	(Zeitun,Tian & Keen, 2007).
Default Risk	DR	Measured by using expected default probability	(Bharath and Shumway, 2008)

The formula for calculation of Expected Default Probability (EDP) is as follows

$$DD_{i,t} = \frac{log\ log\ \left(\frac{Equity_{i,t} + Debt_{i,t}}{Debt_{i,t}}\right) + \left(r_{i,t_{-1}} - \frac{\sigma^2 V_{i,t}}{2}\right) * T_{i,t}}{\sigma v_{i,t} * \sqrt{T_{i,t}}}$$

$$\sigma v_{i,t} = \frac{Equity_{i,t}}{Equity_{i,t} + Debt_{i,t}} + \sigma_{Ei,t} + \frac{Debt_{i,t}}{Equity_{i,t} + Debt_{i,t}} * (0.05 + 0.25 * \sigma_{Ei,t})$$

And

$$EDF_{i,t} = N(-DD_{i,t})$$

$\sigma v_{i,t}$Calculated here is time consistent variance.

3.4 Data Collection & Analysis

This study has used data of 286 companies listed on Pakistan Stock Exchange (PSX) KSE of last 27 years from 1995-2021 to investigate the effect of firm specific variables on default risk. The data has been collected from Thompson Reuters DataStream. The data is both time-series and cross-sectional so panel

data estimation is used. Hausman specification test has used to determine whether fixed-effect estimators are better or the random effect estimators. Regression analysis is used for data analysis.

4.0 Results:

The following section provides results of data analysis.

4.1 Descriptive Statistics:

Table 1 presents the main descriptive statistics for the dependent and independent variables of the study.

Table 1: Descriptive Statistics:

	DR	FR	TAN	SIZE	ROA	OCR	FG	LIQ
Mean	0.3032 9	0.6340 4	0.5565 1	15.583 5	6.8195	14.914 0	0.0434 2	1.3196 0
Median	0.3160	0.6090	0.5714	15.520	6.5950 0	0.2373 7	0.0588 2	1.0900 0
Maximum	0.7254	5.8791	1.0000	20.500	103.99	4628.3	44.042	9.6700
Minimum	1.10E-	0.0361	0.0007	10.371	-49.35	-672.91	-1	0.0000
Std. Dev.	0.1331	0.3545	0.2061	1.6134	9.5632	140.94	0.8297	0.9546
Skewness	-0.2971	4.4283	-0.1956	0.1051	0.3048	19.607	40.392	2.8547
Kurtosis	2.8201	45.100	2.4763	3.0348	9.3687	516.32	2141.6	15.689
Observation s	3696	3696	3696	3696	3696	3696	3696	3696

The mean value of firm growth is 63 % with a minimum of approximately .036 and maximum of 5.87. The mean value of return on asset (ROA) is 6.8195 with a minimum of approximately -49.35 and maximum of 4628.33.

4.2 Panel Unit Root Test:

The following table presents the results related to panel unit root which is applied to check the stationarity of the data series.

Table 2: Panel Unit Root Results

Variables	Panel unit root test: Summary				
	Method	Statistic	Prob.**	sections	Obs
	Null: Unit root (assumes common unit root process)				
DR	Levin, Lin & Chu t*	-58.4166	0.0000	273	3604
FR	Levin, Lin & Chu t*	-516.933	0.0000	287	4077
TAN	Levin, Lin & Chu t*	-10.0433	0.0000	286	4069
SIZE	Levin, Lin & Chu t*	-25.5967	0.0000	287	4077
ROA	Levin, Lin & Chu t*	-30.4102	0.0000	284	3789
CFO	Levin, Lin & Chu t*	-328.838	0.0000	272	3547
FG	Levin, Lin & Chu t*	-90704.6	0.0000	287	4077
LIQ	Levin, Lin & Chu t*	-83.798	0.0000	285	4059

The p-values related to all variables are less than .05 which means all data series are stationary at level.

4.3 Redundant Fixed Effects Test:

Table 3 provides the results related to redundant fixed effect which is used to choose the efficient estimator between the pooled least squares method and the fixed/random effects model.

Table 3: Redundant Fixed Effect results

Redundant Fixed Effects Tests			
Equation: Untitled			
Test cross-section fixed effects			
Effects Test	Statistic	d.f.	Prob.
Cross-section F	12.63713	-2,853,443	0.0000
Cross-section Chi-square	2673.945	285	0.0000

The p-value related to redundant fixed test is less than .05 which means the better estimator for this data set is fixed/random effect model.

4.4 Hausman Test:

Hausman test was applied to check which model is appropriate for this data set between fixed effect and random effect model. Table 4 provides results related to Hausman test.

Table 4: Hausman Test

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	37.716955	6	0.0000

The hypothesis related to Hausman test is as follows.

H_1: Fixed effect model is preferred over random effect model

For this data set the value of probability is .000 so the researcher has rejected the null hypothesis which means fixed effect model is appropriate in this study.

4.5 Fixed Effect Results:

The following table represents results of regression based on fixed effect model.

Table 5: Fixed Effect Results

Dependent Variable: EDF				
Method: Panel Least Squares				
Sample: 1995 2021				
Periods included: 27				
Cross-sections included: 286				
Total panel (unbalanced) observations: 3735				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**

C	0.526456	0.03207	16.41	0.0000
LIQ	-0.044505	0.002276	-19.55	0.0000
FG	-0.005311	0.001603	-3.3125	0.0009
ROA	-0.001997	0.000184	-10.825	0.0000
SIZE	-0.011466	0.001869	-6.1339	0.0000
TAN	-0.021185	0.012563	-1.6862	0.0918
CFO	-0.0000721	0.00000971	-7.43314	0.0000
FR	0.061435	0.006817	9.0127	0.0000
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0.699732	Mean dependent var		0.302183
Adjusted R-squared	0.674354	S.D. dependent var		0.1336
S.E. of regression	0.076273	Akaike info criterion		-2.2340
Sum squared resid	20.03012	Schwarz criterion		-1.7473
Log likelihood	4464.052	Hannan-Quinn criter.		-2.0609
F-statistic	27.57196			
Prob(F-statistic)	0.00000			

The R-squared value is .6999 which means that almost 70% variations in dependent variable are explained by all independent variables in the model. The probability value of F-statistic is 0.0000 which means the model is good fit for the study. The results shows significant negative effect of firm liquidity (LIQ), Return on Asset (Profitability), Size of firm (Size), Cash flow from operations (CFO) and firm growth (FG) on default risk (DR) which is in line with previous studies and sign of coefficient is also as expected. This means that firm increase in firm liquidity, size, profitability and growth will reduce the default risk of the firm. The p-value related to asset tangibility of firms is 0.0918 which means there is no significant impact of asset tangibility on default risk. Financial risk (FR) has significant positive impact on default risk which is also consistent with previous studies. This means that firms with higher financial risk are more prone to default risk.

5.0 Conclusions and further research recommendations

The finding of study suggest that firms with high level of profitability, Cash Flows, liquidity and growth rate are less risky as compared to firms with lower levels of profitability, liquidity and growth rate. The results also suggest that larger firms are less risky as compared to smaller firms. The study also found that firms with higher level of financial risk are more vulnerable to default because of the greater fixed interest cost.

Although our current results are relevant for management theory and practice, we believe that further exploration of firm specific determinants of default risk on sector (Industry) base can be done to check any

difference in results based on sector. Additionally Financial leverage can be used as a mediator between the firm specific variables and default risk to check the underlying relationship.

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