Predicting Corporate Financial Distress: The Case of Pakistan

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Abstract *In view of corporate lifecycle theory, financial distress is one of the fundamental phase in the life of a firm. Despite being unaffected by Global Financial Crises 2008, that time period proved critical for the corporate sector of Pakistan. This study aims to measures the firm-level financial distress in Pakistan by employing the bankruptcy models of Altman-(1968), Ohlson-(1980), Zmijewski-(1984) and JZ-(2016) for all non-financial firms for the years, 2002-2014. The major findings show that Z-score is the best bankruptcy forecast model, followed by Zmijewski model. This study has significance and policy implications as it will help to choose best bankruptcy studies for timely prediction of financial distress leading towards bankruptcy and helps firms to trigger corrective measures thus helping firms from entering into failure.*

Introduction

The financial crises of 2008 has been greatest downturn since the Great Depression that started with the bursting of housing bubble and gave rise to the collapse of many markets, financial institutions including banks, corporate sector in United States (US) and has its effect on the other economies too (Persakis & Iatridis, 2015). This crisis has a deep impact on the US economy as its gross domestic product (GDP) declined by 2% in 2009, followed by Euro crises and has been affecting the countries in Europe since 2009. Luchtenberg and Vu (2015) reported transmission of contagion all along crises period especially in the US and other developed markets that transmit as well as receive contagion. Chira and Marciniak (2014) in their study during the European Crises of 2010-2012 show the increase

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in total risk during the crises period. These crises result in harmful economic effects and introduce adverse business conditions for the corporate sector. For example, Ford reported a 57% decrease in its profit, General Motors (GM) lost $ 361 million in the second quarter of 2012 in Eurozone, Whirlpool reported a 7% decline in its sale during 2012 in Middle East, Europe and Africa (Zhao, Jiang, & Li, 2015).

Simply financial distress (FD) introduces to a situation when there are probabilities that a firm is not going to fill its financial obligation. Carmichael (1972) defines FD as situation that a firm encounters in fulfilling its obligations i.e. insufficient liquidity, insufficient equity and default on debt. Foster (1978) describes FD as severe liquidity crises that can't be fixed except for large scale restructuring efforts. The ultimate result can be default which may lead the firm toward bankruptcy. Chen, Weston, and Altman (1995) describe the firm in distress where the total value of creditors claim exceeds the firm's valuation of total liquid assets. Whitaker (1999) includes a firm in FD condition when the cash flow of its 1st year is less than its current long-term debts. Platt and Platt (2002) describe FD as the ending phase of firm failure which is preceded by the more critical happening of a liquidation. JAFFE, WESTERFIELD, and ROSS (2002) describe FD as a situation where the cash flow of an entity can't fulfill the current obligations and corrective actions are required by the firm. Thus, before going towards the last stage of bankruptcy there is a number of stages that can be recognized and is in accordance with the findings of (McKee, 2003).

FD is always considered a costly event because of its outcomes and consequences. Campello, Graham, and Harvey (2010) indicate that FD companies cut down on investment, innovation, technology, employment, marketing etc. in comparison to unconstrained companies. These financial constraints not only make it difficult to continue the valuable projects but also decrease the chances to gain other attractive investment. Halpern, Kieschnick, and Rotenberg (2009) identify structure of debt far more important determinant of the likelihood of highly leveraged transactions encountering FD. As distress firms have probability of failure in paying its obligation, the shares of distress firms tend to move together and sometimes risk cannot be reduced through diversification. So, investor charges a premium for carrying the risk of uncertainty in such firms. Campbell, Hilscher, and Szilagyi (2008) show that distress portfolio has lower return, higher deviation and market risk and this underperformance is generated among all the stocks of FD firms.

The East Asian crises (1997) and the Global Financial Crises (GFC) of 2008 didn't have its drawbacks on the Pakistani economy i.e. (Dungey and Gajurel 2015) in their study on contagion and banking crises documented China and Pakistan are among the Asian markets that didn't face the spillover and aftershocks of GFC 2008. Pakistan was among the countries that were least affected by GFC (2008) but the corporate sector of Pakistan remained in distress during this time span, for example the energy sector of the country has caused severe difficulties for financial managers subjected to the limited availability of financial means; a considerable part of revenues has been consumed for the solution to energy problems (Malik, 2012). This situation gave rise to FD, the textile sector, which is the foundation of half of Pakistan's exports and 40% of industrial jobs had been under tough circumstances and firms that used mitigative measures other than self-generation recovered on average output losses of about 29 % approximately (Kessides, 2013). Another study by (Siddiqui et al., 2008) reported total industrial output loss that varies between 12%-37% because of electricity shortage and categorized food and beverage, textile and chemical industries being most affected sectors. This decrease in value-added led to a likely loss of industrial employment of approximately 300,000 labors (Aziz et al., 2010). Similarly, terrorism also effect the corporate sector during this regime. (MengYun et al., 2018) computes the impact of non-economic variables such as terrorism, political establishment and GFC 2008 on firm level equity in Pakistan and reported significant negative impact of terrorism on firm equity.

The time period selected for this study has been proved critical for the corporate sector of Pakistan as observed by the huge number of bankruptcies. Pakistan was among the countries that were least affected by GFC (2008) but the corporate sector of Pakistan remained in distress during this time span. According to the statistics by PSX (Pakistan Stock Exchange), this period is characterized by maximum number of delisting i.e. liquidation and bankruptcy. This means financial performance indicators like accounting ratios and market variables can be best described to check for FD and failure in Pakistani corporate sector. The above facts provide the opportunity to explore this area of research and this objective is achieved through measuring FD leading toward bankruptcy by various renowned bankruptcy studies.

Literature Review

The most well-known and widely used study to predict bankruptcy is Altmans-1968 model i.e. Z-score, which uses MD analyses (Multivariate-Discriminant).

The model has not just proved its predictability in past but also used in current researches in predicting failures. Almamy, Aston, and Ngwa (2016) conducted study on United Kingdom (UK) based firm sample by adding cash flow to the original Z-score variables and found high predictability for the health of UK based firms. Z-score also has contribution to other areas of accounting and finance i.e. it has been used for measuring bankruptcy problem in areas like mergers and disinvestment, assets valuation and market performance, capital composition, credit risk estimation, high beta securities, and bond assessments and portfolios, such as (Lasfer, Sudarsanam, & Taffler, 1996; Shrieves & Stevens, 1979) used this model as liquidation proxy for merger and divestment activities. Sudarsanam and Lai (2001) applied Z-Score model to categorize distress firms. (Ferguson & Shockley, 2003; Griffin & Lemmon, 2002; Katz, Lilien, & Nelson, 1985) employed this model to study asset pricing, distress risk and market efficiency. Dichev (1998) investigated the company risk factor and its relationship to size following the Z-score and O-score models to investigate systematic risk of bankruptcy. Moreover, (Graham, 2000; Molina, 2005) used this model as proxy for the determination of capital structure. Similarly, (Altman, 2002; Marchesini, Perdue, & Bryan, 2004) included Z-score for dealing with distress securities.

The Z-score has also established its worth for unconventional businesses. Saif H. Al Zaabi (2011) applied modified Z-score to estimate financial pursuance and predict failure of Islamic Banking in the UAE context and found Z-score as the suitable model in determining the performance. This model is also used largely in measuring firm's financial soundness in going concern concept e.g. (Carcello, Hermanson, & Huss, 1995; Louwers, 1998; Mutchler, Hopwood, & McKeown, 1997).

Ohlson proposed the logit model being more rational than the MDA model for bankruptcy prediction as dependent variable has only two choices i.e. bankruptcy or non-bankruptcy. Like Z-score, O-score also has predictive power to measure FD and many bankruptcy studies are based upon this model, like (Campbell et al., 2008; Dichev, 1998) in their studies used Ohlson O-score for measuring bankruptcy prediction and financial risk and Utrero-González and Callado-Muñoz (2015) used Ohlson framework model for estimation of firms value in relation to corporate governance policies.

Another model that attracts much attention in the bankruptcy literature and repeatedly followed in studies is given by Zmijewski-(1984). Zmijewski in his studied raised two important technical issues associated with bankruptcy prediction models i.e. selective sampling biasness and complete data set biasness

and used probit technique to develop insolvency forecast. Scholars also widely used Zmijewski-(1984) in their research work (Grice & Dugan, 2003). Oude Avenhuis (2013) investigated the predictability of bankruptcy models of Z-score, O-score and Zmijewski on the sample of Dutch companies for the year 2011 and 2012. Miglani, Ahmed, and Henry (2015) measured the FD based upon the model framework of the Zmijewski.

Since the development of Z-score, many studies add extensions or make alterations in the original Z-score to enhance predictability. A recent study in this context contains the research work of (Almamy et al., 2016), which contribute to Altman's original bankruptcy research by combination of cash flows to existing ratios. Results have shown that cash flows when added to the original Z-score, has significantly improved its predictability. Comparing with Altman's Z-score-(1968), JZ-UK has the predictability of 82.9 and in consistent with the studies i.e. (Taffler's 1982).

Since most of the bankruptcies in Pakistan occur in the recent years, the literature on predicting financial distress is also limited. These studies are limited both in term of distress measuring techniques i.e. most of studies focus only on one technique such as Z-score for measuring distress and number of observations are also limited in terms of time duration and industry diversification. Rashid and Abbas (2011) categorize the accounting ratios that are most substantial determinant of bankruptcy prediction for non-financial sector in Pakistan. The bankruptcy prediction rate was 76.9 using Z-Score and most of companies that go bankrupt show the signs of financial distress. Ijaz and Hunjra (2013) measure the financial distress of sugar industries (second largest sector listed at PSX) in Pakistan. Z-score and current ratios were used to predict the financial status of all sugar industry for the period 2009-2010. The result indicates that both tools are reliable measures for the prediction of financial distress and many financial distress firms belong to sugar industry listed on PSX. Roomi et al. (2015) measure the financial status of non-financial firms and Z-score was found to be an effective tool for measuring distress and the study further explore the expected potential of failure for firms listed on PSX with lower capital firms being more FD as compare to higher capital firms. By overviewing the above literature, it can be concluded that most of the bankruptcy studies in Pakistan are based on a single method i.e. Z-score and are also limited in terms of their scope.

A recent trend is growing to predict FD and make comparison of the various bankruptcy models through their predictive power on the basis of accuracy rates. For example, (Kumar & Kumar, 2012; Oude Avenhuis, 2013; Wallace, 2004)

made bankruptcy comparative analyses by employing the bankruptcy models of Altman-(1968), Ohlson-(1980), and Zmijewski-(1984). The present study aimed at finding the generalizability of above bankruptcy models with the addition of new JZ-score that incorporates cash flows to the genuine Z-score, for the listed non-financial sector in Pakistan.

Data collection

The accounting and financial data are collected from the OSIRIS database, Balance Sheet Analysis publishes by State Bank of Pakistan (SBP) and firms' annual reports. The sample comprised of non-financial corporations which are registered on Pakistan Stock Market in 2002. Final selection results in the collection of financial data of 505 listed firms with 4252 firm-years observation with every firm has financial data for at least four consecutive years. The SBP has classified the non-financial sector into 12 industrial segments. A similar industrial classification is used in this study. Table 1 provides information about the sample of the industries used in the study.

The time period selected for this study includes observation in database ranges from 2002-2014 because this study considers before, during and after the GFC 2008 scenario. Because of the data limitation and constraint, two standards are used for measuring bankruptcy. Bankrupt firms are classified as those, which are declared bankrupt or the firms whose EBIT is non-positive for four sequential financial years. However, firms whose EBIT is negative for four consecutive years but has positive EBIT in last year is excluded from the sample of bankrupt firms. In literature, many studies have used this standard for measuring corporate distress. Jostarndt (2007) measures corporate default and described the firm in distress if its EBIT is lesser as compared to it interest expenditures for the two sequential years. Because the measure is used for predicting bankruptcy, the number of years has been increased to four. On the contrary, financially healthy firms are classified as those, which do not have negative EBIT for consecutive four years.

Table 1. Sample Distribution

Industry	Listed sample firms	Percentage of Firms
Textile	190	37.62
Food	57	11.28

Chemical and Pharmaceuticals	31	6.13
Other Manufacturing	45	8.91
Non-metallic	76	15.04
Fuel and Energy	32	6.33
Motor Vehicles and Auto parts	19	3.76
Information, Comm. and Transport	12	2.37
Electrical Machinery and Apparatus	7	1.38
Coke and Petroleum Products	6	1.19
Paper, Paperboard and Products	9	1.78
Services Activities	21	4.16
Total	**505**	**100**

(Source: Author, 2017)

Empirical analyses

Bankruptcy Models

Altman model 1968

The Altman Z-score has an overall precision rate of 74.24%. For 4252 firm-years observation, 1519 firm-years observation have a score below 1.8 and have been categorized as bankrupt firms. 1365 firm-years observation have values above 3 and fall in the safe zone. The firms' years observation restricted in the gray zone is 1347 as their scores are between 1.8 and 2.67. In the sample of 4252 firm-years observation, 155 observations are categorized as Type-I error i.e., a firm is bankrupt but didn't declared to be bankrupt and 939 are Type-II error i.e., a firm is non-bankrupt but declared to be bankrupt. The Z-score has a higher frequency of type-II error i.e. 22% in comparison to Type-I error, which is 3.6%. The result is similar in the context with the other studies done on Pakistan i.e.(Rashid & Abbas, 2011).

Ohlson model 1980

For Ohlson O-Score, the precision rate for the estimated sample of listed Pakistani firms is 45.48%. For the above sample, 1162 firm-years observation are categorized as bankrupt, while 2066 firm-years observation are categorized as non-bankrupt. In this sample, 321 firm-years observation or 7.54 % of firms are

categorized as type I error and 937 firm-years observation or 22.04 % are categorized as type II error. This case is also same as that of Z-score, means the percentage of type II error is greater. For the Ohlson-1980 original study, the precision rate was 96.12%. However, when applied to listed sample of Pakistani firms, it has an overall accuracy of 45.48 %.

Zmijewski model 1984

The above model for the sample of Pakistani firms has an overall accuracy of 72.8 % or 3096 firm-years observation. For the total 4252 firm-years observation, 1337 firm-years observation are categorized as bankrupt while 2891 firm-years observation are categorized as non-bankrupt. In the accuracy sample of 3096 firm-years observation, 479 firm-years observation are categorized as bankrupt and 2617 firm-years observation are categorized as non-bankrupt. For this model, 246 firm-years observation or 5.78% firms have been categorized as type I error and 857 firm-years observation or 20.15 % firms have been categorized as type II error. The precision rate for actual Zmijewski-1984 model was 99%. These results are consistent with the other studies done in this context using Zmijewski-1984 model for listed Pakistani firms. For example, (Jahanzeb, Naslmosavi, & Memon) gave the similar results with the inclusion of cash flow slightly enhance the predictability of the model.

JZ model (2016)

The JZ-score when applied to the above sample of listed Pakistani firms, provides surprising results. Out of 4252 firm-years observation, 4122 firm-years observation or 96.94% of firms have a score below 1.8 and have been declared as bankrupt. Figures of firm-years observation that fall in the gray zone accounted for 97 or 2.28 % of the above sample and only 15 firm-years observation fall in the safe zone area. The model made an accurate prediction of just 18 % or 766 firm-years observation, out of which 712 firm-years observation are precisely categorized as bankrupt and 95 firm-years observation are precisely categorized as non-bankrupt. The fraction of type-II error is much greater as compared to type-I. Only 26 firm-year observations or 0.62% are categorize as type I error whereas 3460 firm-years observation or 81.375% firms are categorized as type II error. At first, it looks that the model has correctly identified all the bankrupt firms but

proportion of type II error is very high which makes the result suspicious and decreased the overall accuracy of this model.

Evaluation of bankruptcy models

A classification matrix containing the numbers has been developed to affirm the predictability of
above models. The general precision rate is the proportion of correct allocation to the total number of allocation and this overall precision can be divided into right prediction between bankrupt and non-bankrupt corporations. The final sample is being used to measure the predictability of aforementioned bankruptcy models.

Table 2. Predictability of Bankruptcy Models

Predicted				
Bankruptcy Models	**Experient**	**Bankrupt-Firms**	**Non-Bankrupt-Firms**	**Right Forecasts**
Z-Score	Bankrupt	583 (13.71%)	155 (3.64%) [a]	583 (18.47%)
	Non-Bankrupt	939 (22.08%) [b]	2553 (60.04%)	2553 (80.87%)
	Overall			3157 (74.24%)
O-Score	Bankrupt	208 (4.89%)	321 (7.54%) [a]	208 (10.75%)
	Non-Bankrupt	937 (22.04%) [b]	1699 (40%)	1699 (87.85%)
	Overall			1934 (45.48%)
ZHI-Score	Bankrupt	479 (11.26%)	246(5.78%) [a]	479(15.47%)
	Non-Bankrupt	857 (20.15%) [b]	2617 (61.55%)	2617 (84.54%)
	Overall			3096 (72.81%)

JZ-Score	Bankrupt	712 (16.74%)	26 (0.62%) [a]	712 (92.95%)
	Non-Bankrupt	3460 (81.37%) [b]	95 (2.23%)	95 (12.40%)
	Overall			766 (18.01%)

[a] Type-I error: a firm is bankrupt but didn't declared to be bankrupt
[b] Type-II error: a firm is non-bankrupt but declared to be bankrupt

Table-2 shows that Z-score has an overall precision rate of 74.24%. This model correctly identified 13.71% of bankrupt firms and 60.04 % of non-bankrupt firms. The proportion of type-I error and type-II error is 3.64% and 22.08% respectively.

The O-score has an overall precision rate of 45.48%. This model correctly identified 4.89% of bankrupt firms and 40% of non-bankrupt firms. The proportion of type-I and type-II error is 7.54% and 22.04% respectively.

The Zmijewski model has an overall precision rate of 72.81%. This model correctly identified 11.26% of bankrupt firms and 61.55% of non-bankrupt firms. The proportion of type-I and type-II error is 5.78% and 20.15% respectively.

JZ-score, which is an extension of the genuine Z-score and adds cash flows to the exiting ratios give unexpected results and has an overall precision rate of just 18.01 %. The model correctly identified most of the bankrupt firms but the proportion of type-II error is much higher i.e. firms are non-bankrupt but declared to be bankrupt (81.37%).

In order to perform the robust check, the selection criteria are restricted from four years of consecutive negative EBIT to five years of consecutive negative EBIT and actual bankrupt firms. With the increase to five consecutive years of negative EBIT, the number of bankrupt firms decreases from 98 to 93 firms, while the other criteria remain the same. We can say that our results are robust. The robustness check concludes the study which are in consistent with the original results.

Conclusion

The previous bankruptcy studies have limitations because they are done using limited performance measures and the scale of thee studies is also limited. In this study, four bankruptcy models are used. The final sample results in 505 non-financial firms for the years 2002-14. To evaluate and compare the above

bankruptcy models, accuracy rate has been developed to make comparison of the results of these models. Altman Z-score has an overall precision rate of 74.24%. The model correctly identified 13.71% of firms as bankrupt and 60.04 % of non-bankrupt firms. The proportion of type-I and type-II errors for Altman's-1968 model is 3.64% and 22.08% respectively. The Ohlson-1980 bankruptcy model has an overall precision rate of 45.48%, whereas this model correctly categorized 4.89% of firms as bankrupt and 40% of non-bankrupt. The proportion of type-I and type-II errors for the model of Ohlson-1980 is 7.54% and 22.04% respectively. The bankruptcy model of the Zmijewski-1984 has an overall precision rate of 72.81%, the model correctly identifies 11.26% of firms as bankrupt and 61.55% firms as non-bankrupt. The proportion of type-I error is 5.78% and type-II error is 20.15% for Zmijewski-1984 model. The ZJ-score which is an extension of the original score has an overall precision rate of just 18.01%, the model correctly identified maximum of the bankrupt firms but the percentage of type II error is extremely high i.e. all the firms which are non-bankrupt are falsely categorized as bankrupt.

Results indicate that Z-score has a higher precision rate for bankruptcy prediction in the context of Pakistan as compared to the other bankruptcy models. After Z-score, the Zmijewski-1984 model gives better results, both in terms of accuracy rate and frequency of errors. However, the JZ-score (2016) is not found suitable for predicting bankruptcy in the Pakistani context as the model gives misclassified results. At first, it looks that the model has correctly identified all the bankrupt firms but proportion of error i.e. type II is very high (81.37). Such type of results are also given in some other studies, for example, Oude Avenhuis (2013) performed bankruptcy study on the sample of listed and large Dutch firms, where Zmijewski model categorized none of the firms as bankrupt, but precisely categorized 99.4% firms as non-bankrupt firms. In conclusion, it is summarized that Z-score model given by Altman in 1968 is the most suitable method to measure FD among non-financial firms of Pakistan.

The risk factor for FD can be examined in two aspects, inside factors and outside factors. This study has significance and policy implication with respect to inside risk factors for corporate sector of Pakistan. The FD studies in the form of bankruptcy models can serve as an early warning indicator system for predicting FD, thus inducing the corrective actions and plan for future perspective.

In addition to traditional techniques that are based on financial indicators, hybrid intelligent techniques are potentially useful models for FD prediction. Meanwhile, with the development of computing and modeling techniques, some

new techniques may also be useful for solving the problems of FD prediction and can also be done on the account of industry effects i.e. textile industry in Pakistan.

This paper uses bankruptcy models based on accounting ratios. This has certain implications; the quality of accounting information can affect the accuracy of results and the financial variables can also be distorted. Also, there exist data constraints in the form of missing values i.e. financial information is not available for certain years, especially the data for bankrupt firms is not up-to-date, etc.

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