# Prediction of Financial Distress: A Comparative Study

Asif Taj* Saleha Azam** Dr.Gulfam Khan Khalid***

*Riphah International University, Islamabad
**Office of Research Innovation & Commercialization, NUML
***National University of Modern Languages, Islamabad

## Abstract

*The purpose of this study is to identify the variables having a potential to predict the financial health of the companies and to make a comparison between Multi discriminate analysis and Logit regression analysis to identify the better model for the future researches. The data was obtained from Balance Sheet Analysis published by the State Bank of Pakistan. Two groups were developed. The group of defaulted textile companies in between 2005 to 2010 was paired up with the healthy textile companies identified with the top market capitalization. The MDA and LRA were performed by using SPSS. It was found that the variables of Sales by Total Assets, Accounts payables and Notes payables by Total Assets, Sales by Tangible Fixed Assets, Return on Equity, Liquid Assets by Current Liabilities and Earnings before Interest and Taxes by Paid up Capital were significant variables as proved by both of the models. The variables of Sales by Total Assets, Sales by Tangible Fixed Assets, Liquid Assets by Current Liabilities and Earnings before Interest and Taxes by Paid up Capital were in accordance with the past researches while the variables of Accounts payables and Notes payables by Total Assets and Return on Equity were contrary to the past researches as hypothesized. The variables of Sales by Working Capital, Working Capital by Long Term Debt and Working Capital by Total Assets were further identified in addition to these variables by LRA as significant variables. Further, it was proved that both MDA and LRA are good enough in identification of the variables to predict the financial distress of the companies. However, LRA was slightly a better model by providing more number of variables identified, by covering more variance in dependent variable and above of all by providing more predictive power with accuracy. The results were discussed in accordance with the tables produced by the both of the tests and by making a comparison of both models leading towards the implications for the business and financial managers and providing a base for future research in any other scenario.*

**Keywords:** Financial Distress, Multi-Discriminate Analysis, Logit Regression Analysis, Karachi Stock Exchange, State Bank of Pakistan

## Introduction

The number of noteworthy studies has been conducted by the researchers in various economies to explain the financial distress and variables to develop the prediction models have been identified therein. The efforts have been extended by developing various methods, models or techniques to

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be applied for evaluating the prediction of financial health of the companies in different economies. In Pakistan, according to the data published by SBP regarding analysis of non-financial companies listed on KSE large number of textile companies defaulted during the years from 2005 to 2010. According to Pakistan Textile Journal (2008), the prices of electricity, gas and petroleum has been increased from 2005 onwards reducing the production and export of textile sector. Salam (2008) explained that the variation in the prices of raw material required to the textile sector has disturbed the demand and supply equilibrium of textile sector. Riaz (2008) identified the consequent effect as decline in the strategic relationship between suppliers and buyers of the textile sector. This critical situation requires a study to be conducted to validate the financially distressed position of the textile sector.

The prior studies for prediction of financial distress focus on the phenomena of financial distress by relying on any one of the best prediction model selected which results in identification of variables only in an isolation without having a relative model available for comparison. This study not only identifies the number of potential variables to predict the financial distress but also makes a comparison between MDA and LRA simultaneously and ultimately identifies the LRA as a better model for prediction. The next section explains the thorough background of the financial distress along with the methods and techniques used by the past researchers to evaluate this phenomena, and improvements and modifications brought therein. The research methodology adopted for this study has been explained next following the results discussion under which all the productivity of both of the tests has been explained respectively and then the results have been discussed in the light of past researches and the relevant association of the results obtained by this study has been proved. The comparative view regarding both of the models has also been mentioned. In last the conclusive discussion has been made followed by some reasonable future directions for the researchers next to this study and for the strategists and practitioners.

## Literature Review

The literature of financial distress has its roots in the first half of the twentieth century when Ramser & Foster (1931) and Hickman (1958) found that financially distressed firms usually document different ratios than the healthy concerns. Beaver (1966) provided univariate analysis which led towards the attempts for the multivariate analysis. Altman (1968) emphasized on MDA to categorize the financial ratios and justified that financially distressed/default position can exactly be speculated up to two years earlier of bankruptcy. Edminster (1972), Blum (1974) & Altman and Lorris (1976) reprocessed the Z-score model and brought some improvements in model regarding utilization of MDA.

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In 1980s, Ohlson provided an O-Score to distinguish between financially healthy and failed companies. An O-Score consisted of nine variables. Lane *et al*. (1986) & Whalen (1991) used the Cox Proportional Hazard model to predict the time factor. According to Back *et al.*, (1994) during the 1990s, Artificial Neural Networks generated better results for bankruptcy prediction. Cole & Gunther (1995) separated the determinants of bank failure from the survival time of failing banks by using a Split-population Survival Model, Logit Survival Model and Cox Proportional Hazard model. Back *et al*. (1996) compared Discriminate, Logit, and Genetic models and noticed the differences while selecting the independent variables in accuracy of bankruptcy prediction and elaborated the different outcomes of different methods used. According to Bongini e*t al.* (2000) the amounts invested in property and plant led the firms operating in Asian region towards the bankruptcy. According to Altman (1984) and Charitou *et al*., (2004) the literature has mostly admitted the MDA as a popular internationally acknowledged failure predictive model.

Pongsatat *et al*. (2004) conducted a research in Thailand by using both Altman's model and Ohlson's model and found Altman's model as a better predictive model regarding bankruptcy. Later on, Bandyopadhyay (2006) conducted a research in India by using both Z-Score approach and Logistic approach and found it highly successful regarding prediction of bank default. Chen, (2008) also emphasized that the LRA has been recently used in number of financial prediction researches. According to Madrid-Guijarro et al. (2011) the selected financial variables should be applied on the unanimous research elements or on the same sector to avoid cross-sector effects. The same has been followed in this study. Cabo & Rebelo (2012) also identified the number of financial variables to predict the insolvency of the firms while Nigib et al. (2013) emphasized at the proper utilization of the results obtained by these financial prediction studies by the relevant strategists. So, the above discussed literature review identified not only the MDA and LRA as a phenomena for identification of financial variables but also to make a comparison between both of the models to be use for the prediction in the under-developing country like Pakistan and the utilization of the same by the relevant decision makers. However, the constructs of selected twenty independent variables through hypothesis have been shown as follows.

**Hypothetical Development**

The researchers like Ramser and Foster (1931) and Altman (1968) conducted studies at different timeframes not only to explain the variable of Sales divided by Total Assets but also declared that this financial variable has a negative and significant impact on financial distress.

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*H-1 It is therefore, hypothesized that Independent variable of SATA will have a negative and significant impact on the Dependent Variable of Financial Distress.*

Sharmand & Mahajan (1980), Lane *et al*, (1986), Whalen (1991), Cole & Gunther (1995), and Ravid & Sundgren, (1998) elaborated the variable of Shareholders' Equity Divided by Total Assets by conducting numerous studies and declared that this financial variable has a significant but negative impact on financial distress as the improved equity position of the company reduces the financial distressed position of the company.

*H-2 It is therefore, hypothesized that Independent variable of SETA will have a negative and significant impact on the Dependent Variable of Financial Distress.*

The researcher like Chatterjee *et al*, (1966) conducted a research and interpreted the variable of Accounts payable and Notes payable divided by Total Assets and mentioned that this financial variable has a positive and significant impact on financial distress.

*H-3 It is therefore, hypothesized that Independent variable of APNPTA will have a positive and significant impact on the Dependent Variable of Financial Distress.*

The researchers like Deakin (1972) and Mine Ugurlu & Hakan Aksoy (2006) examined the variable of Sales divided by Current Assets by conducting a research and declared that this financial variable has a significant but negative impact on financial distress.

*H-4 It is therefore, hypothesized that Independent variable of SCA will have a negative and significant impact on the Dependent Variable of Financial Distress.*

Edminster (1972), Sharmand & Mahajan (1980) and Ariel R. Sandin Halliburton (2007) examined and explained the variable of Sales divided by Working Capital by conducting a research and identified that this financial variable has a negative and significant impact on financial distress.

*H-5 It is therefore, hypothesized that Independent variable of SWC will have a negative and significant impact on the Dependent Variable of Financial Distress.*

The researchers like Altman (1968) and Mine Ugurlu, Hakan Aksoy (2006) conducted a study and interpreted the variable of Sales divided by Net Tangible Fixed Assets and mentioned that this financial variable has a negative and significant impact on financial distress.

*H-6 It is therefore, hypothesized that Independent variable of STFA will have a negative and significant impact on the Dependent Variable of Financial Distress.*

Altman, Haldeman & Narayanan (1977) and Hotchkiss (1995) conducted a research and elaborated the variable of Earning before Interest, Taxes, Depreciation and Amortization divided by Total Assets and mentioned

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that this financial variable has a significant but negative impact on financial distress.

*H-7 It is therefore, hypothesized that Independent variable of EBITDT will have a negative and significant impact on the Dependent Variable of Financial Distress.*

Mine Ugurlu, Hakan Aksoy (2006) conducted a study and explained the variable of Net Working Capital divided by Long Term Debt and declared that this Financial Variable has a significant but negative impact on Financial Distress.

*H-8 It is therefore, hypothesized that Independent variable of WCLTD will have a negative and significant impact on the Dependent Variable of Financial Distress.*

Altman, Haldeman & Narayanan (1977) and Opler & Titman (1994) conducted a research and elaborated the variable of Market Value of Equity divided by Total Liabilities and identified that this financial variable has a significant but negative impact on financial distress.

*H-9 It is therefore, hypothesized that Independent variable of MVETL will have a negative and significant impact on the Dependent Variable of Financial Distress*.

Fitzpatrick (1932) and Mine Ugurlu, Hakan Aksoy (2006) examined and explained the variable of Fixed Assets divided by Shareholders Equity by conducting a study and identified that this financial variable has a significant and positive impact on financial distress.

*H-10 It is therefore, hypothesized that Independent variable of FASE will have a positive and significant impact on the Dependent Variable of Financial Distress.*

Teija & Maria (1999) and Prihti (1975) explained the variable of Total Debt divided by Total Assets by conducting a research and identified that this financial variable has a positive and significant impact on financial distress.

*H-11 It is therefore, hypothesized that Independent variable of TDTA will have a positive and significant impact on the Dependent Variable of Financial Distress.*

Mine Ugurlu & Hakan Aksoy (2006) examined the variable of Long Term Debt divided by Total Debt by conducting a research and declared that this financial variable has a positive and significant impact on financial distress.

*H-12 It is hypothesized that Independent variable of LTDTD will have a positive and significant impact on the Dependent Variable of Financial Distress.*

The Researchers like Blum (1974) and Ariel R. Sandin Halliburton (2007) conducted researches and explained the variable of Net Income divided

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by Shareholders Equity and declared that this financial variable has a significant but negative impact on financial distress.

*H-13 It is therefore, hypothesized that Independent variable of ROE will have a negative and significant impact on the Dependent Variable of Financial Distress.*

The researchers like El-Hennawy & Morris (1983) and M. Virag & T. Cristof (2005) conducted studies and interpreted the variable of Quick Liquidity Ratio as Current Assets minus Inventory divided by Current Liabilities and mentioned that this financial variable has a negative and significant impact on Financial Distress.

*H-14 It is therefore hypothesized that Independent variable of LACL will have a negative and significant impact on the Dependent Variable of Financial Distress.*

Edminster (1972), Altman et al, (1977) and Teija & Maria, (1999) studied the variable of Cash and Bank divided by Current Liabilities by conducting a research and declared that this financial variable has a negative and significant impact on financial distress.

*H-15 It is hypothesized that Independent variable of CSCL will have a negative but significant impact on the Dependent Variable of Financial Distress.*

Andreas *et al.* (2004) and Ugurlu M. (2000) conducted researches and explained the variable of Earning Before Interest and Taxes divided by Paid up Capital and signified that this financial variable has a significant but negative impact on Financial Distress.

*H-16 It is therefore, hypothesized that Independent variable of EBITPC will have a negative and significant impact on the Dependent Variable of Financial Distress.*

The researchers like Beaver (1966), Altman, (1968) and Deakin, (1972) conducted studies and explained the variable of Working capital divided by Total Assets and declared that this financial variable has a significant but negative impact on financial distress.

*H-17 It is therefore, hypothesized that Independent variable of WCTA will have a negative and significant impact on the Dependent Variable of Financial Distress.*

Andreas *et al.* (2004) conducted a research and elaborated the variable of Operating Income divided by Total Liabilities and identified that this financial variable has a significant but negative impact on financial distress.

*H-18 It is therefore hypothesized that Independent variable of EBITL will have a negative but significant impact on the Dependent Variable of Financial Distress.*

The researchers like Chaterjee *et al.* (1966) and Ariel et al. (2007) conducted studies and explained the variable of Earning before Interest and

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Taxes divided by Sales and declared that this variable has a significant but negative impact on financial distress.

*H-19 It is therefore Hypothesized that Independent variable of EBITS will have a negative and significant impact on the Financial Distress.*

Ariel *et al*. (2007) examined and explained the variable of Long Term Debt divided by Total Assets by conducting a study and identified that this variable has a significant but negative impact on financial distress.

*H-20 It is therefore hypothesized that Independent variable of LTDTA will have a negative and significant impact on the Financial Distress.*

## Research Methodology

### Population & Sample Size

The focus of this study is to extend the empirical evidence of comparative financial distress of Pakistani textile companies. Islamabad Stock exchange, Lahore Stock Exchange and Karachi Stock exchange are currently operating in Pakistan. KSE is main index of the economy and largest Stock Exchange among all Pakistani Stock Exchanges and was considered for this study. As per Balance Sheet Analysis published by SBP for the years 2005 to 2010 as on 31st December, 2010 there were 411 non-financial companies listed on the KSE reflecting 12 sectors. There are 164 companies listed related to textile sector and 147 companies reflecting all twelve sectors out of 411 total companies which defaulted during 2005 to 2010. This study requires the manufacturing concerns as sampling units therefore the textile sector of the KSE has been focused to stream-line not only the sample but also the tests due to be run to draw the focal results. From the total population ten years complete data of 56 companies out of 85 which defaulted during the period of 2005 to 2010 were taken as sample on the basis of Convenience Sampling technique and data availability of such companies which are paired up with non-defaulted companies accordingly.

### Data Collection & Pairing

This study is conducted by relying on the secondary source of data available at Balance Sheet Analysis provided by the SBP. This type of information was considered as most reliable and economical source of information. According to Mine Ugurlu & Hakan Aksoy, (2006) in the past studies both sale values & total assets values of the defaulted and non-defaulted companies have been used as proxy for pairing the defaulted and non-defaulted companies. The seventy-five companies were selected due to availability of data. Out of seventy-nine, seventy-five textile companies were having the highest market capitalization; converting them into ascending order. The top most 56 companies with the highest market capitalization were taken as a paired sample group to conduct a comparison with non-defaulted companies.

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The year of 2005 was selected as median period splitting the time-frame into two parts to obtain the optimum level of largest market capitalization of the textile sector of the KSE. The quarterly average market prices of all the textile companies were obtained from B-Recorder. The quarterly average shares prices of all four quarters of 2005 were stream-lined then the net average of all averages was obtained. The same net average was multiplied with the number of shares outstanding of each company as mentioned already. The total market capitalization results of all textile companies were then compared with the companies which defaulted during the period mentioned. The data of 73 with respect to market capitalization out of 85 companies was available on the B-Recorder. The same was utilized for further proceedings. These companies were then set in order of highest market capitalization to lowest market capitalization. The top most 56 companies with the highest market capitalization were then considered as second segment of research element to finally obtain the top most healthy textile concerns to make a paired sample for a comparison regarding prediction of financial distress.

**Data Entry & Coding**

The selected data of independent variables was entered into excel then was imported in SPSS. The data was vertically re-organized and was coded as "0" for healthy companies and "1" for defaulted companies. For MDA, the dependent variable of financial was selected into the main box and all the independent variables were entered into the independent variable box. All the tests were checked accordingly and test was performed. Likewise LRA was performed, which identified nine variables. The same variables were however re-entered into the LRA and all tests were checked and the Tables for both of the tests were obtained that are discussed in next section. However, both of the MDA and LRA were performed on the finalized data.

## Results and Analysis

**Multiple Discriminate Analyses (MDA)**

The MDA is performed in SPSS. Group Statistics are obtained which identify the significant differences between the groups with respect to every independent variable taken in the model. It has to observe that the group means value of each and every independent variable in a comparative manner to identify the level of separation. The significant discriminators were SATA, APNPTA, STFA, ROE, LACL, EBITPC, SETA, EBITDT, MVETL, TDTA, and LTDA due to large differences existing in their mean values. SATA, APNPTA, STFA, ROE, LACL and EBITPC are significantly identified with respect to hypothetical integration and are proved in next tables at the value of .000 along with the directional integration whether positive or negative. The rest of the discriminators are not significant at .000. Therefore, these variables are not taken as significant predictors for dependent variable. The Test of

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equality of group means is performed it identifies the verification of significant differences between the group means of the default and healthy companies for entire independent variable as by providing the high "F" values of the independent variables as the most significant variables are APNPTA with the significant value at .000 and highest F value of 123.545, second highest significant variable is LACL with significant value at .000 and F value of 102.960, third highest significant variable is SATA with significant value at .000 and with F value 56.107, fourth highest significant variables is STFA with the significant value at .000 and F value of 48.440, fifth significant variable is EBITPC with significant value at .000 at F value of 20.708 and sixth significant variable is ROE with significant value at .019 and F value of 5.551 while rest of the variables are not significant at .000 and are with low F values. Further, the pooled within the group matrices not only justifies the outcome of the first two tables but also makes a support to those results as the inter-correlation between all the variables has been found as very low.

Table1. *Log determinant table*

| DV | Rank | Log Determinant |
|---|---|---|
| 0 | 16 | 70.439 |
| 1 | 16 | 114.093 |
| Pooled within groups | 16 | 119.263 |

The ranks and natural logarithms of determinants printed are those of the group covariance matrices. In MDA the null hypothesis that covariance matrices do not differ between the both groups of dependent variable firstly, the log determinants should be equal that are not equal $70.439 \neq 114.093$ between the both groups violating the assumption of null hypothesis that the defaulted and healthy companies do not differ is not retained. Secondly, it is not supposed to be significant where the Box's M test is 11860.627 with the F value of 83.968 which is significant at $p < .000$ however it does not matter in the large data as taken in this particular study.

Table 2. *Box's M Test Results*

| Box's M | 11860.627 |
|---|---|
| Aprrox. | 83.968 |
| df1 | 136 |
| df2 | 610303.14 |
| Sig. | 0.000 |

Table 3. *Eigen values*

| Function | Eigen Value | % of Variance | Cumulative % | Canonical Correlation |
|---|---|---|---|---|
| 1 | .653[a] | 100 | 100 | 0.629 |

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The discriminate function obtained is one less than numbers of the groups available as there are only two groups available in this study which is defaulted and healthy companies. So, there is only one function available to provide all the relevant information. It proves that this model as overall as a fit model but also explains the variance in the dependant variable due to independent variables as the value of canonical co-relation is .629 which explains the (.629 X .629) 39.56% variation in the dependent variable that the companies will either default or not.

Table 4. *Wilks'Lambda Values*

| Test of Function(s) | Wilks' Lambda | Chi-square | df | Sig. |
|---|---|---|---|---|
| 1 | 0.605 | 219.615 | 16 | 0.000 |

As there is only one function available to provide all the relevant information. Wilks' Lamda explains the significance of the discriminate function i.e. (p<.000) highly significant in this case. However, it also identifies the unexplained portion of the variance in the dependent variable i.e. 60.44%. The reason of such unexplained portion is the low number of variables incorporated in the study due to large number of companies' data.

Table 5. *Standardized Canonical, Structure Matrix & Canonical Discriminant Functions*

| Standardized Canonical Discriminant | Function 1 | Structure Matrix | Function 1 | Canonical Discriminate | Function 1 |
|---|---|---|---|---|---|
| SATA | -0.752 | APNPTA | -0.652 | SATA | -1.323 |
| SETA | 0.829 | LACL | -0.595 | SETA | 0.002 |
| APNPTA | -0.595 | SATA | -0.439 | APNPTA | 0 |
| SCA | 0.425 | STFA | -0.408 | SCA | 0.175 |
| STFA | -0.108 | EBITPC | -0.267 | STFA | -0.067 |
| EBITDT | 0.588 | ROE | 0.138 | EBITDT | 0.044 |
| MVETL | -0.042 | EBITS | -0.093 | MVETL | -0.001 |
| FASE | -0.061 | TDTA | 0.085 | FASE | -0.012 |
| LTDTD | 0.006 | SETA | -0.085 | LTDTD | 0.008 |
| ROE | 0.18 | EBITL | -0.075 | ROE | 0.002 |
| LACL | -0.203 | EBITDT | 0.073 | LACL | 0 |
| CSCL | -0.028 | FASE | -0.066 | CSCL | -0.215 |
| EBITPC | -0.21 | LTDTA | 0.059 | EBITPC | -0.045 |
| EBITL | -0.114 | LTDTD | 0.055 | EBITL | -0.356 |
| EBITS | -0.005 | MVETL | 0.036 | EBITS | -0.023 |
| LTDTA | 0.662 | SCA | 0.027 | LTDTA | 0.004 |
| | | CSCL | -0.009 | (CONSTANT) | 1.291 |

This table identifies the direction (positive or negative) of the association existing between the independent variable and dependent variable. The significant variables as identified by the test of equality of group means are SATA, APNPTA, STFA, ROE, LACL and EBITPC. The variable of

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SATA is significantly but negatively associated with the dependent variables in accordance with past researches and as the results obtained by Ramser & Foster (1931) and Altman (1968). The variable of STFA is significantly but negatively associated with the dependent variables in accordance with past researches and as the results obtained by Altman (1968) and Mine Ugurlu & Hakan Aksoy (2006). The variable of LACL is significantly but negatively associated with the dependent variables in accordance with past researches and as the results obtained by Hennawy and Morris (1983). The variable of EBITPC is significantly but negatively associated with the dependent variables in accordance with past researches and as the results obtained by Ugurlu (2000) and Andreas *et al*, (2004). The variable of APNPTA is significantly but negatively associated with the dependent variable of financial distress in contradiction with the results of Chatterjee *et al*. (1966). The variable of ROE is significantly and positively associated with the dependent variable of financial distress is also in contradiction with the results of Blum (1974) and Halliburton (2007). The reason for such contradictions in the results of these variables is according to Rahman & Ali (2006) who conducted a research on the companies listed at Islamabad Stock Exchange during 1994 up to 2004 and concluded that the working capital management policies inclusive of credit policies, have the discretion or ability to affect the returns which the companies adopt to fulfill their financial requirements.

So, in the light of above findings it is proved that hypothesis H-1, 6, 14 and 16 are not only significant but are also in accordance with the past researches as demonstrated above. Hypothesis No.3 and 13 are although significant yet are contrary with the past works done by the researchers as demonstrated above with respect to direction (positive or negative) between independent variables and dependent variable. However, rest of the hypothesis H-2, 4, 5, 7, 8, 9, 10,11, 12, 15, 17, 18, 19 and 20 are rejected at all as all of these are found as insignificantly associated with the dependent variable. The Structure Matrix function explains the potential of the independent variable with respect to the dependent variable. It is more reliable than standardized canonical discriminant function coefficients. It explains the correlation of every independent variable with the discirminant function. The results provided by this function are however as same as the results of the standardized canonical discriminant function coefficient table. Further, the Canonical discriminant function identifies all the values required to develop the discriminant function. These discriminant coefficients explains the contribution each variable with respect to the discriminant function with good control over the entire variables. The discriminant function can be developed as follows:

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$$D = (SATA\ X - 1.323) + (SETA\ X.002) + (APNPTA\ X.000) + (SCA\ X.175) + (STFA\ X - .067) + (EBITDT\ X.044) + (MVETL\ X - .001) + (FASE\ X - .012) + (LTDTD\ X.008) + (ROE\ X.002) + (LACL\ X.000) + (CSCL\ X - .215) + (EBITPC\ X - .045) + (EBITL\ X - .356) + (EBITS\ X - .023) + (LTDTA\ X.004) + 1.291$$

Table 6. *Functions at Group Centroids*

| DV | Function 1 |
|---|---|
| 0 | -0.819 |
| 1 | 0.794 |

This table explains the group differentiation of the dependent variable on the basis of group wise means of the independent variables. It elaborates that the defaulted companies have a mean of -.819 while the healthy companies have a mean of .794.

Table 7. *Classification Results* [a, c]

| DV | | | Predicted Group Membership | | Total |
|---|---|---|---|---|---|
| | | | .00 | 1.00 | |
| Original | Count | .00 | 175 | 45 | 220 |
| | | 1.00 | 35 | 192 | 227 |
| | % | .00 | 79.5 | 20.5 | 100.0 |
| | | 1.00 | 15.4 | 84.6 | 100.0 |
| Cross-validated [b] | Count | .00 | 172 | 48 | 220 |
| | | 1.00 | 39 | 188 | 227 |
| | % | .00 | 78.2 | 21.8 | 100.0 |
| | | 1.00 | 17.2 | 82.8 | 100.0 |

a. 82.1% of original grouped cases correctly classified.
b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.
c. 80.5% of cross-validated grouped cases correctly classified.

This table is also known as confusion table in which the dependent categories are presented on horizontal axis and the independent categories are presented on vertical axis. The values pointed out on the diagonal axis are verification of the perfect prediction up to 79.5% for healthy and 84.6% in defaulted companies. While their cross verification is also 78.2% for healthy companies and 82.8% for defaulted companies. Further, 82.1% original group cases are correctly classified while 80.5% of cross validated group cases are also correctly classified.

**Logistic Regression Analysis (LRA)**

Table 8. *Classification Table* [a, b]

| Observed | | | Predicted DV | | |
|---|---|---|---|---|---|
| | | | .00 | 1.00 | Percentage Correct |
| Step 0 | DV | .00 | 0 | 220 | .0 |
| | | 1.00 | 0 | 227 | 100.0 |
| Overall Percentage | | | | | 50.8 |

a. Constant is included in the model. b. The Cut Value is .500

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Table 9. *Variables in the Equation*

| | B | S.E. | Wald | df | Sig. | Exp (B) |
|---|---|---|---|---|---|---|
| Constant | 0.03 | 0.1 | 0.11 | 1 | 0.74 | 1.032 |

The Logistic Regression Analysis (LRA) creates the classification table that produces the results with the constant only and identifies/considers this table as a base to compare it with the model produced later on after identification of significant variables by the "variables not in the equation table" and then entering those variables as a (forward stepwise method-likelihood ratios) into an equation and producing a new and improved model with better predictive accuracy. This table identifies that in the absence of the input from the independent variables the predictive accuracy can be made up to 50.8% accurately.

Table 10. *Variables not in the Equation*

| | Score | df | Sig |
|---|---|---|---|
| SATA | 50.049 | 1 | 0.000 |
| APNPTA | 97.133 | 1 | 0.000 |
| SWC | 447 | 1 | 0.000 |
| STFA | 43.881 | 1 | 0.000 |
| WCLTD | 413.65 | 1 | 0.004 |
| ROE | 5.507 | 1 | 0.019 |
| LACL | 83.99 | 1 | 0.000 |
| EBITPC | 19.876 | 1 | 0.000 |
| WCTA | 447 | 1 | 0.000 |

This table identifies the nine variables of SATA, APNPTA, SWC, STFA, WCLTD, ROE, LACL, EBITPC, WCTA that are significantly associated at the values of .000 with the dependent variable. Therefore the hypothesis of H-1,3, 5, 6, 8, 13, 14, 16 and 17 are accepted while rest of the hypothesis of H-2, 4, 7, 9, 10, 11, 12, 15, 18, 19 and 20 are rejected as these are not significantly associated with the dependent variable. Further, by adding these variables into the equation the predictive accuracy can be improved up to 87.1% (see classification table 2.8 below).

Table 11. *Omnibus Tests of Model Coefficients*

| | Chi-square | Df | Sig. |
|---|---|---|---|
| Step | 285.13 | 1 | 0.000 |
| Block | 285.13 | 1 | 0.000 |
| Model | 285.13 | 1 | 0.000 |

This table identifies that the each of the independent variable entered into the equation contributes the significant effect to the dependent variable or not. The chi-square has 1 degree of freedom with a value of 285.130 referring to a probability of $p < 0.000$ showing that our model is a poor fit which simply means that all the identified predictive variables and then entered into the

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equation have the significant effect on the dependent variable. For this purpose, further tests are to be applied on the data set.

Table 12. *Model Summary*

| Step | -2 Log likelihood | Cox & Snell R Square | Nagelkerke R Square |
|---|---|---|---|
| 1 | 335.787[a] | 0.471 | 0.628 |

a. Estimation terminated at iteration number 8 because parameter estimates changed by less than .001

This table identifies the Cox & Snell R-square value at .471 which means that such Logistic Regression Model holds the potential of 47.1% to evaluate the variation made in the dependent variable due to selected independent variables. However, the value of Nagelkerke R-square which is comparatively better than previous one i.e. MDA which explains that the selected variables have a strong relationship with the prediction up to 62.80%.

Table 13. *Hosmer and Lemeshow Test*

| Step | Chi-square | Df | Sig. |
|---|---|---|---|
| 1 | 121.746 | 8 | 0.000 |

This table which is also known as H-L Statistic identifies the chi-square value at 121.746, degree of freedom at 8 and above all is significant at .000 which shows that this model is not a good fit which means that all the variables identified above have the significant effect on the dependent variable.

Table 14. *Contingency Table for Hosmer and Lemeshow Test*

| Step1 | DV = .00 | | DV = 1.00 | | |
|---|---|---|---|---|---|
| | Observed | Expected | Observed | Expected | Total |
| 1 | 45 | 45 | 0 | 0 | 45 |
| 2 | 41 | 44.852 | 4 | 0.148 | 45 |
| 3 | 43 | 41.854 | 2 | 3.146 | 45 |
| 4 | 40 | 31.777 | 5 | 13.223 | 45 |
| 5 | 26 | 18.659 | 19 | 26.341 | 45 |
| 6 | 11 | 11.364 | 34 | 33.636 | 45 |
| 7 | 6 | 8.288 | 39 | 36.712 | 45 |
| 8 | 5 | 6.542 | 40 | 38.458 | 45 |
| 9 | 0 | 1.337 | 10 | 8.663 | 10 |
| 10 | 3 | 10.327 | 75 | 67.673 | 78 |

Table 15. *Classification Table*

| Observed | | | Predicted (DV) | | Percentage Correct |
|---|---|---|---|---|---|
| | | | 0 | 1 | |
| | | 0 | 175 | 45 | 79.5 |
| | DV | 1 | 13 | 215 | 94.3 |
| Step 1 | Overall Percentage | | | | 87.1 |

[a] The cut value is .500

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Table 16. *Variables in the Equation*

| | B | SE | Wald | df | sig | Ex(B) |
|---|---|---|---|---|---|---|
| Step 1 | 0 | 0 | 84.245 | 1 | 0.000 | 1 |
| Constant | 1.88 | 0.189 | 99.237 | 1 | 0.000 | 6.553 |

This table leads towards the Logistic Equation as by simply identifying the Wald value of the APNPTA that is sig .000 which means that the variable of APNPTA has a significant contribution in the dependent variable. The B values are considered as logistic coefficients used to produce the predictive equation as follows:

Probability= e(.000XAPNPTA)+Constant/1+e(.000XAPNPTA)+constant

Supposed APNPTA = 1,000,000

Now Probability=2.72(.000X1,000,000)+1.880/1+2.72(.000X1,000,000)+1.880

Probability = 6.5612 / 7.5612 = 0.861 = 86.1%

**Summary of Results**

The MDA and LRA tests have been performed by using SPSS provided significant results regarding identification of independent variables to predict the financial distress of the companies. Each aspect of the results has been explained minutely in accordance with the tables produced. Six independent variables of SATA, APNPTA, STFA, ROE, LACL and EBITPC were identified by the MDA. Nine variables of SATA, APNPTA, STFA, ROE, LACL, EBITPC, SWC, WCLTD and WCTA were identified by LRA. The variables of SATA, STFA, LACL and EBITPC were significant and in accordance with past researches as discussed above. The variable of APNPTA and ROE were although significant were yet contrary to the past researches with respect to their directional association with the dependent variable of financial distress. Six variables of SATA, APNPTA, STFA, ROE, LACL and EBITPC were common in both of the tests showing their potential for further researches however three variables of SWC, WCLTD and WCTA were identified in addition by LRA.

Table 17. *Comparison of MDA and LRA*

| | MDA | LRA | Remarks |
|---|---|---|---|
| No. of variables identified | 6 | 9 | LRA>MDA |
| Significance level (Model fit) | 0 | 0 | LRA=MDA |
| Variance covered | 39.56% | 62.80% | LRA>MDA |
| Variance not covered | 60.44% | 37.20% | LRA>MDA |
| Predictive accuracy | 82.10% | 87.10% | LRA>MDA |

The variance covered by MDA was 39.56% while LRA was 62.8%. The equations of both of the models were successfully derived and were explained accordingly. The success rate to accurately predict the financial distress was MDA with 82.1% and LRA was 87.1% explaining that both of the above mentioned models are good enough to predict the financial distress

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equally however LRA identified slightly a better model because of more number of variables identified, more variance covered and with higher predictive accuracy. Further, the results of the same can vary by relying on the data of different companies of any other developing economy.

## Conclusion

The organizations usually aim to understand the currently internal, external and forthcoming circumstances and factors that could affect their business and can cause disturbance in financial health of the organizations. The financial analysts, managers and researchers are interested in the identification of potential variables for prediction of financial distress. They can consider the variables identified in this study for not only to evaluate the financial health of the company but also for financial prediction. APNPTA and LACL refer to avail the credit facilities. The companies rely more upon the credit facilities due to higher rate of interest in the economy under crises without maintaining the balance in the conversion cycle. These companies may lead towards more default risk however the liquidity plays a significant role to reduce the variance. SATA and STFA identify the asset's potential to contribute in the sales as an internal driven factor seems better in the healthy companies as these companies. These companies are investing more than defaulted companies in their fixed assets and their efficient and effective deployment. However, the equity of the business affects the profitability as ROE and EBITPC have also been identified by both of the models. The companies meeting the capital requirements efficiently are considered as safe as resulted in this study and vice a versa. This study achieved its objects by not only identifying the number of variables which consists the potential to predict the financial distress of the companies but in also to make a comparison MDA and LRA. The past researches relied upon to make a hypothetical integration and evaluated the potential of different variables which led towards the results produced and discussed above. Both of the models identified prominent results for an exemplary comparison however LRA was proved as better model. So the stake-holders of any company who may rely upon the solidity proved by these models for their investment or any other corporate/financial decision associated with any company. The future research may be extended to the company data of other stock exchanges of Pakistan or to the data of any stock-exchange listed companies of another economy.

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