

Analysis of the Power of Predicting Financial Distress of Jordanian Industrial Firms Listed in Amman Stock Exchange Using logistic regression for the period (1995-2014)

Fatima Zohra Kerroucha^{#11}, D.Mohamed Bensaid^{#2}, Halim Naimi^{*3}

#Djillali liabes University –Departement of economic sciences- Sidi Bel Abbes- Algeria

**Belhadj Bouchaib center university Ain temouchent-Departement of management- Ain temouchent -Algeria*

¹kerrouchafatima@hotmail.fr

(PhD student and teacher assistant rank A)

²benssaide@yahoo.fr

(doctor in university and membership in research lab management of enterprise)

³halimugta@gmail.com

(master in strategy and human resources management)

Abstract This study aimed to find a model consisting of a set of financial ratios in which each ratio has its own weight that indicate its importance in discriminating between industrial distressed and non-distressed firms in Jordan. The early prediction of industrial firm's distresses warns the concerned parties that they can intervene and take corrective actions before the collapses of institution. To achieve this, twenty seven ratios were calculated for 1 to up 3 years

before actual distress for a sample of thirty eight industrial firms, half of which had failed.

These ratios were analyzed using the statistical method known as the logistic regression to reach the best form of financial ratios that can distinguish between industrial distressed and non-distressed firms in the first, second and third year before distress. It has already been reached that the best model in predicting corporate failure is the model which was built in the first year before distress and which included twelve financial ratios, has been able to this form of re-classification of industrial companies to distressed companies and non-distressed companies with accuracy amounted to 92.9% in this year, the determining coefficient of this model which expresses its goodness of fit has reached 90.4%. To ensure the ability of this model to predict failed industrial companies and non-failed industrial companies, it was tested on another sample of industrial companies (out of sample) of ten firms half of which had failed enabling the model to distinguish between these companies accurately amounted to 90% in the first year before distress.

The study finished with some useful recommendations. The most important of them is the utilization of the proposed model by the companies control department, Ministry of industry & Trade, current and prospective investors and company management in order to predict financial failure of industrial companies in Jordan. The study, also, recommended the inclusion of non-financial indicators such as firm size, its age, the various economic variables,...etc, as well as financial indicators such as financial ratios when building mathematical models to predict financial failure.

Keywords: Prediction, Distress, Financial ratios, Industrial firms, Jordan, Logistic analysis.

I. Introduction

Predicting the financial failure of companies is one of the main topics that many international institutions have dealt with, due to its negative impact on companies, investors and the economy as a whole. The importance of financial forecasting also lies in helping decisions makers to take the appropriate decisions as far as financing is concerned. In addition to this, this latter helps reduce the degree of uncertainty as it provides an evaluation of the potential risk that may happen in the future.

As the progress of any society relies to a large extent on the success of its companies, it becomes critical to predict the financial failure of these companies to reduce or avoid the bad impact and consequences it's may have.

¹ Corresponding author

Thus, the purpose of financial analysis is to provide the appropriate data about the financial situation of a company as well as to evaluate its performance in a given period of time. It also helps to provide information about the extent to which any company has succeeded or failed to achieve its goals. Besides, this analysis permits the identifications of the indicators that show whether the company policy is appropriate or needs to be modified, helping thus in making the correct decisions within the institutions.

Due to the growing importance of financial statements, the need of financial indicators has evolved for many reasons among which one may cite: * making the appropriate decisions;* evaluating the financial situation of the company as well as its performance in a given period of time;* forecasting the financial failure and provide some security to the people who deal with these companies.

Predicting company's failure is also useful in the sense that it allows the administrations to take the appropriate decisions in the appropriate time to recover and get better.

Consequently, this study was considered in the definition of distress that industrial companies are those companies that made losses for three consecutive years.

The rest of the paper is organized as follows: In section two we present a literature review on the relationship. Section three evokes the model and the methodology, followed by the results and discussion in Section four, and finally, section five presents the main conclusion of this research.

II. Problem of the Study

The problem of the study Highlights of the need of many parties of investors, lenders and auditors, and others, to see the company's ability to survive and continuity away from failing due to the negative impact of distress companies on the national economy and the consequent of many problems as happened to find Petra Bank and the Bank of Jordan and the Gulf in the end of 1992 and many industrial companies. Since there is no indication to the use of industrial companies in Jordan and those interested in a model consists of a set of financial ratios to predict the distress of these companies before it happens, it means perhaps that the latter still rely on traditional methods of financial analysis as the reliance on these traditional methods which is based on the analysis of financial ratios of each individual, may reflect the picture is not clear-cut of the financial situation of the company and thus lead to the decisions of administrative and financial unclear, so any financial ratio can it reflect the picture of the financial situation of the company is different from what reflected other financial ratio for the same company, and given the multiplicity of uses financial ratios, it is useful to

know any of these ratios which, if used together can give an accurate prediction from the failures of industrial companies before it occurs period of time to help the latter to take appropriate action and possible solutions before it is too late.

Accordingly, this study raises many questions which they can inference about the importance of the problem of the study:

1. You could develop a mathematical model is able to distinguish between distressed companies and non-distressed companies in the first year before distress using logistic analysis?
2. You could develop a mathematical model is able to distinguish between distressed companies and non-distressed companies in the second year before distress using logistic analysis?
3. You could develop a mathematical model is able to distinguish between distressed companies and non-distressed companies in the third year before distress using logistic analysis?
4. Will the proposed model built in the first year, which will be reached accurately distinguish between distressed companies and non-distressed in the test sample, in the first year before faltering?

III. The Objective of the Study

This study aims to develop a mathematical model using the logistic analysis, consisting of a set of financial ratios, where each percentage of them weighing weighted, which reflects the degree of importance in predicting the distinction between industrial companies distressed and non-distressed, before tripping one year at least, to be used in predicting distress of Jordanian industrial companies. The objectives of the study can be summarized in the following points:

1. The main objective of this study is to try to develop a model consisting of a set of financial ratios for each of the three years preceding the distress using logistic regression to distinguish between industrial companies distressed and non-distressed companies.
2. . Test the model's ability to predict and apply it to another sample of industrial companies, which did not make it in the construction of the proposed model, in the first year before distress.

IV. The Importance of the Study

This study is gaining importance first of the importance of the industrial sector and its role in the national economy to be considered an indicator of economic development indicators.

Second of interest applied to the model quantitative study aims to develop when analyzing the published financial statements of the companies, and the possibility of universal use of this model in the Jordanian industrial sector, which will add a new

financial indicator can be relied upon by investment decision makers.

The study highlights the importance of practice in that predict the distress before hindsight gives an early warning about the risk of default, hence predict corporate distress before a period stumbling of many benefits for many stakeholders, the results of these companies.

The prediction of distress enables investors to identify the fate of their investments and the disposal of investments in companies that are going in the way of failure and directing their investments to companies that are not expected to failure, and also can creditors reassurance on loans granted to companies and make decisions granting new credit. As for management, it can eliminate the causes of distress before they escalate and take the necessary corrective decisions, and for auditors, they can identify the company's ability to continuity and, finally, even the government can exercise its regulatory function to the fullest, allowing them to intervene in a timely manner.

V. The Literature Reviews

Many of the studies in most countries, the global developed and undeveloped countries dealt the subject of financial distress and ways to predict it, where many of those studies tried devise models appropriate to find models suitable for predicting bankruptcy or failure of companies in most sectors in the countries of the world, and will be reviewed in chronological order her:

Studies create models to predict the failure of companies has begun in the late sixties of the last century. One of the first studies in this field as in [3], which used the analysis of single variables and compare 14 financial ratios of companies failed to a group of successful companies and concluded that the financial ratios of the companies failed different financial ratios for companies successful, and that the ratio of cash flow to debt was the most important ratio to distinguish between these companies .Instead of them, [2] has used 22 financial ratios in building a financial analysis model discriminatory multi variables(stepwise multivariate discriminant analysis) .He has reached a model that can predict the failure of companies in the year prior to the occurrence, using several financial ratios together with accurately arrived to 95%. And then appeared a lot of studies that have followed the approach Altman, and used a set of financial ratios to build statistical models using discriminatory analysis and logit analysis and methods of statistical again, they reached to support the hypothesis of the possibility of the use of financial ratios in building models can predict the distress of companies with high accuracy.

A. *Example of these studies [5]* The researcher study on the possibility of using financial ratios to predict the distress of industrial companies General food in Syria, and try to develop a model that could benefit from it for predicting distress of

these companies, so it is an important indicator to judge the performance of such industrial companies, was by analyzing 10 financial ratios derived from the financial statements a sample of 22 companies for tracking food industrial public sector in Syria, 12 of them failed and 10 is non-failed in the period (1999-2000) using discriminatory analysis .

The researcher found a form consists of 3 ratios can be used to predict the failure of companies, namely: the rate of external funding, liquidity ratios rapid, profitable sales.

About the accuracy form in predicting distress of the companies is 100% in the study, 87.5% in the first year before faltering, 82.5% the second year before faltering, 79.17% the third year, 66.67% of the fourth year before faltering.

B. Study [7]

This study aims to use financial ratios and analysis methods discriminatory and logistical support to the establishment of statistical models to predict the failure of public shareholding companies listed on the Amman Financial Market, the study included 26 companies failed and 26 successful company, was obtained from the evidence public shareholding companies during the period (1991-2002). 25 ratio was used were classified into financial liquidity and profitability ratios, leverage and activity.

The researcher found that the discriminatory form and logistical they can predict the failure of companies with an accuracy of 96.2% a year earlier failure, the ability of these models to predict has decreased the beginning of the second year to the fifth year prior to failure.

C. Study [1]

This study aimed to reach the best possible range of financial indicators that can be used to predict a financial distress of public companies listed in Amman stock exchange by using two statistical models discriminant analysis and logistic regression. To achieve this, twenty four ratios were analyzed for a sample of fifty six companies (eighteen healthy companies and thirty eight distressed companies) for the period (2007-2011).

The study found that the discriminatory model witch contains four financial ratios: return on equity, retained earnings to total asset, fixed asset to equity right, net profit after tax to total asset and logistic model witch contains three ratios: return on equity, fixed asset to equity right, net profit after tax to total asset can predict the failure of public companies with an accuracy of 84.2% for healthy companies and 83.3% for distressed companies. The study that the return on equity is the most able to predict financial failure in all the years of research.

D. Study [8]

This study was conducted to examine the ability of artificial neural network method to predict financial failure in the Tehran Stock Exchange. The study sample consisted of 47 failed company and 120 non-failed companies listed on the Tehran Stock Exchange for the period (2006-2011) through the analysis of 16 financial ratios derived from the financial statement of these companies.

The study was concluded that the developed model enables the re-classification of companies in the sample within the two groups of distressed and non-distressed categories with accuracy amounted 98.8%, 97.3%, 95.2%, 94.2%, 93.2% in the first, second, and third, fourth and fifth years respectively before distress.

VI. The Hypothesis

Based on the problem of the study and an investigation of its goal has been developed following hypotheses to be tested in this study:

1) The logistic model that consists of a set of financial ratios, which will be reached by using the regression method does not distinguish accurately between distressed companies and non-distressed companies in the first year before distress.

2) The logistic model that consists of a set of financial ratios, which will be reached by using the regression method does not distinguish accurately between distressed companies and non-distressed companies in the second year before distress.

3) The logistic model that consists of a set of financial ratios, which will be reached by using the regression method does not distinguish accurately between distressed companies and non-distressed companies in the third year before distress.

4) The first logistic model does not distinguish accurately between distressed companies and non-distressed companies in the test sample.

VII. The Methodology

A. The Population and the Sample of Study

The study population consists of all industrial companies listed on the Amman Financial Market during the period (1995-2014), of which there are 94 companies, but 26 companies were excluded due to the lack of sufficient financial statements for these companies, being the exercise began its work after the year 2000, and therefore not have the financial statements during the study period.

The study sample consists of a group of distressed companies, and a non-distressed companies is equal to the first group in the number of comparison between the two groups. It has been selected all failed companies, which has made losses for three consecutive years during the period (1995-2009). The total number of those companies 19 companies and then the other sample was selected from 19 industrial companies non-distressed.

The table (I) shows the sample analysis companies and the size of its assets and its financial situation during the years of the study.

The most of the previous studies has followed style selection of a company is unsuccessful for every company failed so they are identical in type of industry and the size of the assets and the same period, but because of the lack of more than one industrial company in many industrial sectors, and provides that there may be a significant difference in the size of the assets, so the sample was selected companies is struggling to reconcile a standard type of industry and the size of the assets as much as possible. In the absence of a successful company similar to the troubled company in the industry type and size of assets have been resorting to another nearby industrial sector of the industry. In case there is a big difference between the two companies in asset size, has been resorting to another industrial sector so that the company be successful as close as possible to the company defaulted on its size.

The researcher on the way in the previously mentioned when choosing a sample of the study, although the method adopted does not require that there is a similarity between distressed companies and non-distressed companies in terms of the type of sector and asset size, but the researcher prefers so as to obtain the results of accurate and objective.

The study focused on the financial statements for the three years of consecutive losses for distressed companies for the purposes of logistic analysis to can build a mathematical model consisting of a set of financial ratios able of predicting a stalled companies and for each of the three years, because the three-year period is sufficient to correct the financial situation in industrial companies to take corrective action to avoid financial distress (as in [4]) and then determine what is the best model can be relied upon to predict the phenomenon of distress.

It is worth mentioning that it is not sufficient to choose the best model among the three models, but it was tested the extent of the built model in the first year before faltering in the application on another sample of companies witch consists of all the other failed companies during the period (2009-2014). It has been shown that there are 5 companies made losses for three consecutive years, then was chosen other 5 companies similar to the five failed companies have to be included in the test sample (table II).

B. Statistical Analysis used in the Study

To achieve this, twenty seven ratios were calculated for a sample of thirty eight industrial firms, half of which had failed, from its financial statement for the fourth year following three years of losses for the purpose of analysis.

These ratios were analyzed using the statistical method known as the logistic regression to reach the best form of financial ratios that can distinguish between industrial distressed and non-

distressed firms in the first, second and third year before distress.

These ratios were unloaded at SPSS program in the form of variable numbered 27 variables so that each variable represents a certain financial ratio. Data were analyzed statistically using logistic analysis (Binary regression) as a method which is compatible with these data. One of the first studies to predict the failure of companies using this model, as in ([6], [9]).

Logistics analysis has been used as a method of multivariate analysis to reach a mathematical model, which consists of a set of financial ratios to predict distress of industrial companies, where this method is used for classification or prediction in studies where the dependent variable is descriptive variable takes two values crossing them (1, 0), which is known as the binomial nominal variables, the case of distress takes the value of 1 and the case of no distress takes 0, while independent variables it can be quantitative or nominal variables.

VIII. The Result and Recommendation

Twenty seven financial ratios derived from financial statements of a sample of 38 companies divided into two equals groups of distressed and non-distressed companies for the period (1995-2009) were analyzed by using the statistical model known as logistic regression to build the mathematical models able to predict the financial distress of Jordanian companies, this study has found the following results:

- The model which was built in the first year before distress consists of 12 financial ratios: the quick ratio, cash flow to total liabilities, net profit before tax to sales, return on assets, return on equity, net profit to Net working capital, return on sales, fixed asset turnover ratio, internal funding ratio, equity right to fixed assets, total liabilities to total assets, then the equity right to total liabilities. The model enables the re-classification of companies that have been used in its design accurately amounted to 92.9%. To ensure the ability of this model to predict distressed companies and non-distressed companies, was tested on another sample of 10 industrial companies (out of sample) half of them are failed and the other half is non-failed, its financial ratios was extracted in the first year before distress, enabling the model of discrimination between these companies accurately reached 90%, while the overall accuracy (prediction accuracy and classification accuracy) of this model, reaching 91.45%. It has been also testing the accuracy of this result in the classification by using the (T-test), results were statistically significant at the 0.05 level of significance.
- The model which was built in the second year before faltering consists of 7 financial ratios: the quick ratio, the proportion of cash flow to total liabilities, net profit to net working capital

ratio, fixed asset turnover ratio, the proportion of domestic financing, equity rights to fixed assets ratio, then the ratio of equity rights to total liabilities. The model enables the re-classification of companies that have been used in its design accurately amounted to 91.2 % .

- The model which was built in the third year before distress contains 9 financial ratios: the quick ratio, the proportion of cash flow to total liabilities, the net profit to net working capital ratio, fixed asset turnover ratio, internal financing ratio, equity rights to fixed assets ratio, the ratio of total liabilities to total assets, then the equity rights to total liabilities ratio, interest coverage rate. The model enables the re-classification of companies that have been used in its design accurately amounted to 83.9 % .
- The findings of the study indicated that the developed model in the first year before failure is a reliable and efficient model with accuracy rate 92.9% and coefficient of determination (as indicator of model's goodness of fit) cox & snell coefficient and nagelkerke coefficient were 0.678 and 0.904 respectively, but the likelihood was (-2loglikelihood=7.102).

The study finished with some useful recommendations. The most important of them is the utilization of the proposed model by the companies control department, Ministry of industry & Trade, current and prospective investors and company management in order to predict financial failure of industrial companies in Jordan. The study, also, recommended the inclusion of non-financial indicators such as firm size, its age, the various economic variables,...etc, as well as financial indicators such as financial ratios when building mathematical models to predict financial failure.

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Table I

Company	Asset Size	The year of the Losses for the Failed Company and the Profits for its Similar	Observation
INOH	60.975.264	2000,2001,2002	Failed Company Make Losses for 3 Year Successive
JODA	60.184.306	2000,2001,2002	Non Failed Company Similar to the Previous
NATP	596.494.18 3	1997,1998,1999	Failed Company Make Losses for 3 Year successive
JOST	596.273.39 0	1997,1998,1999	Non Failed Company Similar to the Previous
NAST	118.941.65 3	1996,1997,1998	Failed Company Make Losses for 3 Year Successive
APHC	117.808.59 4	1996,1997,1998	Non Failed Company Similar to the Previous
JSLC	66.356.292	2000,2001,2002	Failed Company Make Losses for 3 Year Successive
UADI	66.723.486	2000,2001,2002	Non Failed

			Company Similar to the Previous
APCT	87.191.259	2002,2003,2004	Failed Company Make Losses for 3 Year Successive
JOPI	88.037.873	2002,2003,2004	Non Failed Company Similar to the Previous
NDAR	101.858.19 2	2000,2001,2002	Failed Company Make Losses for 3 Year Successive
NATC	115.382.17 5	2000,2001,2002	Non Failed Company Similar to the previous
AMAN	48.837.475	2000 to 2006	Failed Company Make Losses for 3 Year Successive
PERL	47.010.833	2000,2001,2002	Non Failed Company Similar to the Previous
WOOD	143.624.30 9	1997,1998,1999	Failed Company Make Losses for 3 Year Successive
ENPC	143.339.79 7	1997,1998,1999	Non Failed Company Similar to the Previous
TRAV	42.662.415	2001,2002,2002	Failed Company Make Losses for 3 Year Successive
JOIC	37.367.485	2001,2002,2002	Non Failed Company Similar to the Previous
IENG	136.327.53 4	2002 to 2007	Failed Company Make Losses for 3 Year Successive
ASPMM	147.699.65 7	2002,2003,2004	Non Failed Company Similar to the Previous
WIRE	215.040.89 0	2000,2001,2002,2003	Failed Company Make Losses for 3 Year Successive
AIFF	209.286.63 9	2000,2001,2002	Non Failed Company Similar to the Previous
AEIN	122.884.18 9	1996,1997,1998	Failed Company Make Losses for 3 Year Successive
UMIC	120.191.63 8	1996,1997,1998	Non Failed Company

			Similar to the Previous			the profits for its similar	
WOOL	12.471.925	2000,2001,2002	Failed Company make Losses for 3 Year Successive			2010,2011,2012	Failed Company Make Losses for 3 Year Successive
GENM	24.025.670	2000,2001,2002	Non Failed Company Similar to the Previous			2010,2011,2012	Non Failed Company Similar to the Previous
ICER	123.456.44 6	1996,1997,1998	Failed Company Make Losses for 3 Year Successive			2010,2011,2012	Failed Company Make losses for 3 Year Successive
JOIR	124.113.26 7	1996,1997,1998	Non Failed Company Similar to the Previous			2010,2011,2012	Non Failed Company Similar to the Previous
ICAG	193.494.56 8	2004,2005,2006	Failed Company Make Losses for 3 Year Successive			2010,2011,2012	Failed Company Make Losses for 3 Year Successive
GENI	195.930.59 6	2004,2005,2006	Non Failed Company Similar to the Previous			2010,2011,2012	Non Failed Company Similar to the Previous
INMJ	14.237.033	2003 to 2008	Failed Company Make Losses for 3 Year Successive			2010,2011,2012	Failed Company Make Losses for 3 Year Successive
JOWL	25.025.873	2003,2004,2005	Non Failed Company Similar to the Previous			2010,2011,2012	Non Failed Company Similar to the Previous
JPPC	125.498.74 7	2006,2007,2008	Failed Company Make Losses for 3 Year Successive			2010,2011,2012	Failed Company Make Losses for 3 Year Successive
JVOI	122.636.14 4	2006,2007,2008	Non Failed Company Similar to the Previous			2010,2011,2012	Non Failed Company Similar to the Previous
Jordania n dibarra	38.615.484	2005,2006,2007	Failed Company Make Losses for 3 Year Successive				
UNIC	31.214.127	2005,2006,2007	Non Failed Company Similar to the Previous				
JOCF	125.519.35 4	2006,2007,2008	Failed Company Make Losses for 3 Year Successive				
JOPC	133.106.34 2	2006,2007,2008	Non Failed Company Similar to the Previous				
ACDT	28.744.789	2010,2011,2012					
CJCC	28.721.796	2010,2011,2012					
JOSE	12.949.436	2010,2011,2012					
SLCA	12.977.929	2010,2011,2012					
AQRM	57.645.617	2010,2011,2012					
HPIC	65.782.184	2010,2011,2012					
ASAS	85.861.354	2010,2011,2012					
AALU	88.281.452	2010,2011,2012					
JNCC	374.950.858	2010,2011,2012					
JOWM	379.596.547	2010,2011,2012					

Table II

Company	Asset size	The year of the losses for the failed company and	Observation
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