Logit Analysis for Predicting the Bankruptcy of Albanian Retail Firms

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Abstract

The logit analysis is one of the more recent and advanced techniques, used in social sciences to model discrete results. The basis of this analysis is the theory of discrete choice. This theory has to do with the sense of discrete behavioral responses of individuals' actions and market economy the government when faced with two or more results. First, we have analyzed the theoretical and practical characteristics of the logit model and its application in various economic fields. Second, we have examined a sample of 30 retail firms who are active in the period 2010-2012 – 30 companies had had their shares permanently suspended or delisted because of a default. According to the characteristics of commercial businesses, in our study are taken into account many financial ratios, to be representative of the financial situation of these businesses. In this study, we concluded that from the 22 financial ratios taken in consideration only 8 are statistically important. As in many other studies carried out previously for the phenomenon of bankruptcy prediction was confirmed that the financial statements received from the financial statements of businesses serve to forecast this phenomenon. Logit analysis recorded an improvement in the reliability and accuracy of forecasting the phenomenon of bankruptcy compared with multivariate discriminatory analysis. Logit analysis is more reliable because it requires the assumption of normal distribution of variables, which is one of the basic assumptions of the multivariate discriminatory analysis.

Keywords: Logit, bankruptcy prediction models, financial ratio, accuracy

1. Introduction

Logit analysis is one of the more recent and advanced techniques, used in social sciences to model discrete results. The basis of this analysis is the theory of discrete choice. This theory has to do with the sense of discrete behavioral responses of individuals' actions and market economy the government when faced with two or more results.

So the theoretical basis of this model is the theory of consumer behavior in microeconomics. Logit analysis assumes that current reactions are drawings, sketches, extracts from distribution multinominal selected with probabilities based on observed values of individual characteristics and their alternatives.

These types of models are considered as random models. Logit analysis classifies companies' bankrupt and not bankrupt logit based on their scoring and a border point separating the pattern[1].

Logit value for a given company compared with the dividing border point, and if the value is greater logit, then it is more likely that the bankrupt company, and vice versa if the value is smaller logit.

This technique assumes that the dependent variable in the model is dikotom. The function that benefits from this model to predict the bankruptcy is:

P1 (Xi) = 1/ [1 + exp – (B0 + B1X1 + B2X2 +........+ BnXn)] = 1 / [1+ exp – (Di)]

Where: P1 (Xi) = probability of bankruptcy.

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[1] *Balcaen, S., Ooghe, H. (2004), "Alternative methodologies in studies on business failure: do they produce better results than the classic statistical methods?", Vlerick Leuven Gent Working Paper, Series 2004/16*

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Bj = coefficient of attribute j where j = 1 ... n.

Xij = value attribute j (with j = 1... n) for firm i., independent variables, financial reports

Di = value "logit" of the firm.

Logit analysis recorded an improvement in the reliability and accuracy of forecasting the phenomenon of bankruptcy compared with shumëvariable discriminatory analysis. Logit analysis is more robust and reliable because it requires the assumption of normal distribution of variables, which is one of the basic assumptions of the analysis shumëvariable discriminatory.

Logit analysis does not provide a score a point and difficult to interpret as the analysis of multiple discrimination, but a probability which is between 0 and 1. A probability near 0 indicates a low chance to fail and a probability close to 1 indicates a higher probability to fail.

Logit analysis can be viewed and the importance of a single financial report in the model, while the analysis of multiple discrimination can not be tested the statistical significance of the coefficients calculated in the model.

2. Literature Review

Logit analysis can be used two or more dummy variables as the Ohlson model that will be addressed below. This model does not require "equality between companies", ie the same number of companies bankrupt and not bankrupt. But attention should be paid to the completeness of the data, if the data are pjesssme for companies, this would lead to diversion or extreme values. The model results will not be accurate and reliable whether there multikolinearitet between variables.

Among the studies that were based on logit analysis mentioned Begley, Ming and Satts (1996), Berger, Ofek and Swary (1996), Dichev (1998), Zavgren (1985) etc. According Stickney (1996) during 1980-1990 has been the tendency of researchers to use logit analysis of a discriminatory than multiple analyses.

The first researcher who has been used Ohlson logit analysis in 1980. In his model Ohlson included 105 companies bankrupt and non-bankrupt company in 2058. By these companies amounted financial reports for the years 1970-1976

Probability function was:

P1(Xi) = 1/1+ e^{y}

where:

Y= -1.3-0.4X1+6.0X2-1.4X3+0.1X4-2.4X5-1.8X6+0.3X7-1.7X8-0.5X9

X1 = log (total assets / price level index)

X2 = total liabilities / total assets

X3 = working capital / total assets

X4 = liabilities Short / active Short

X5 = 1 if total assets exceed liabilities, 0 otherwise

X6 = net income / total assets

X7 = funds obtained from operations / total assets

X8 = 1 if net income is negative for the past two years, 0 otherwise

X9 = change in net income

Y = risk index or index-O

The accuracy of prediction of this model was 96.4%, an indicator that made this one of the most successful and most used in further studies. Ohlson concluded that the most important factors in predicting the phenomenon of bankruptcy were:

a. Company Size

b. Capital Structure

c. Company Performance

d. Company liquidity indicators

The higher the index-O was the higher risk bankruptcy.Ohlson finds that a border point dividing the value 0.038 minimizes the amount of errors of the first kind and the second kind. A first type of error happens if the index indicator-O is smaller than dividing border points, but in fact the company is bankrupt. If the indicator-O is greater than dividing border points, but in fact the company is not bankrupt, this is the second type of error.

3. Research Metodology

This study on the phenomenon of bankruptcy forecast differs significantly from existing research. Almost all the data used in the current research are extended in some industries, which have made it difficult to identify the causes of bankruptcy because they can vary from one industry another. This study selected only one industry to avoid generalizations of results between industries. The focus of this study focus on one sector of the economy, the commercial sector, in order to formulate reasons why trading units go into bankruptcy based on their business operations.

In all economies, the distribution sector provides an important link and the evolving dynamic between producers and consumers. Trade sector usually provides a significant contribution to the economy wide employment - often being the second largest national economy while simultaneously providing significant contributions and increasing the GDP of a country. During the past three decades this industry is seen as a dynamic and innovative. But also it is seen as one of the industries with the highest rates of bankruptcy.

Even in the district of Elbasan from data published by Instat until the end of 2014 the commercial sector occupies 42.7% of the economy, are trading unit 3354, a total of 7859 active units. From these units the number of which has gone into bankruptcy it is 529 units closed. Most of the units sold, approximately 62% are trading unit. Given this it is necessary to be tailored models that enable prediction of the phenomenon of bankruptcy for this sector of the economy and in the district of Elbasan, because this circle is the focus of this study and can be available easily base database.

4. Sample Selection

The data used in this study are quantitative data obtained from financial statements of commercial entities that are registered with the National Registration Center offices in the city of Elbasan. The financial statements have been downloaded from the website of the National Registration Center, but also through their insurance accounting offices operating in the district of Elbasan, and accounting services to offer these units. Initially gathered financial statements of 55 commercial units currently operate, they are active, or otherwise meet the conditions of their consistency.

National Registration Center publications do not specify the location of an item if it is bankrupt or not, but simply a status of active or inactive unit. According to national accounting standards compilation of financial statements for an entity carried out in accordance with the principle of continuity if the following conditions are met:
1. There is no intention to liquidate unit
2. No order ceases trading activity
3. There is no real alternative to do so

From this sample data they were eliminated units that have extreme values of financial reports compared with other units, and each unit of bankrupt was paired with the unit continuously with size similar assets, and the same year, thus creating a database for 30 units and 30 units on an ongoing basis to consider bankruptcy. However matching procedure tends to be arbitrary (Ohlson 1980). According to Ohlson model it would be more meaningful if variables, ie financial reports as predictors included in the study, rather than simply for reasons of correspondence between companies.

5. Variables of the Model

After being selected enterprises on which the study will be conducted next step is the selection of variables to be included in the econometric model. Because of the limitations in the provision of data on units in the study used only financial data that can be obtained from the financial statements of businesses. According Dimitras et al. (1996) the majority of statistical models use only annual financial information in the form of financial reports for forecasting the phenomenon of bankruptcy. Reasons for the use of financial reports are that they represent reliable information, objective and sustainable financial situation of businesses. In a study conducted by Mossman, 1998, it was concluded that the financial reports are often used in predicting the phenomenon of bankruptcy better than market data.

In our study are taken into account 22 financial reports are thought to be representative of the financial situation of these units. The dependent variable in the model that will be built is the dichotomy variable, dummy variable. This variable takes two values 0 and 1, is determined by the condition of the units, on a continuing basis and bankruptcy.

These financial reports are divided into four groups. Financial reports R1, R2, R3, R4, R5, R6, are grouped as liquidity reports. Financial Reports R7, R8, R9, R10, R11, R12 and R13 are grouped as acrual reports. Financial reports R14, R15, R16, R17, R18, R19 and R20 are grouped structure reports. Financial reports R21 and R22 are

representatives of profitability reports. Financial ratios are calculated for three consecutive years, 2010, 2011 and 2012 as a going concern as well as units for units regarded as bankrupt. The study analyzes three consecutive years in order to determine the time that the accuracy of forecasting the phenomenon of bankruptcy is higher; ie a year before the bankruptcy, insolvency two years or three years before bankruptcy.

6. Hypotheses

In this study it is intended to rise on the basis of analysis models and techniques discussed in the literature and to assess the accuracy of forecasting the phenomenon of bankruptcy for commercial units. Hypotheses raised in this study are:

H01: Model built on multiple discriminatory analyses to forecast the phenomenon of bankruptcy for commercial units in the district of Elbasan is not statistically significant.

H02: Model built on the logit analysis to forecast the phenomenon of bankruptcy for commercial units in the district of Elbasan is not statistically significant.

H03: There is no difference in classification predictive ability of the phenomenon of bankruptcy between model built on multiple and discriminatory analysis model built on logit analysis for commercial units in the district of Elbasan. And the alternative hypothesis which focuses the study is:

H3: There are differences in the predictive ability of the phenomenon of bankruptcy sorting between model built on multiple and discriminatory analysis model built on logit analysis for commercial units in the district of Elbasan.

7. Data Analysis in the Logistic Regression Model

Another analysis that will be used to build the model of forecasting the phenomenon of bankruptcy is logit analysis. One of the advantages of using it is that this analysis is not based on the assumption of normal distribution of variables. Because in general the financial reports are not normally distributed, and some of them are correlated with each other, for the issuance of financial reports used indicator used in some financial reports, this analysis is adequate and model building on this study. Initially, Mann Whitney U test is done to test which of 22 independent variables have higher discriminatory ability between units of bankrupt and non-bankrupt units. Mann-Whitney U test is a nonparametric test that is used to compare differences between two independent groups when the dependent variable is sequential or continuous, but not normally distributed. Below are the results of this test for a year before the bankruptcy variables.

Testi Mann- Whitney U test

	R1	R2	R3	R4	R5	R6	R7
Mann-Whitney U	435.000	445.000	396.000	424.000	395.000	393.000	335.000
Wilcoxon W	900.000	910.000	861.000	889.000	860.000	858.000	800.000
Z	-.222	-.074	-.798	-.384	-.813	-.843	-1.700
Asymp.Sig.(2-tailed)	.824	.941	.425	.701	.416	.399	.089

	R8	R9	R10	R11	R12	R13	R14
Mann-Whitney U	368.000	259.000	362.000	154.500	275.000	378.000	327.000
Wilcoxon W	833.000	724.000	827.000	619.500	740.000	813.000	792.000
Z	-1.213	-2.824	-1.301	-4.369	-2.587	-.864	-1.818
Asymp.Sig.(2-tailed)	.225	.005*	.193	.000*	.010*	.387	.069

	R15	R16	R17	R18	R19	R20	R21
Mann-Whitney U	409.000	429.000	265.000	447.000	425.000	275.000	324.000
Wilcoxon W	874.000	894.000	730.000	912.000	890.000	740.000	789.000
Z	-.606	-.310	-2.735	-.044	-.405	-2.587	-1.863
Asymp.Sig.(2-tailed)	.544	.756	.006*	.965	.686	.010*	.022*

	R22
Mann-Whitney U	442.500
Wilcoxon W	907.500
Z	-.111
Asymp. Sig. (2-tailed)	.912

Source: Author calculators

Logistic regression function obtained by logit analysis model built according to the classification of commercial units in the unit of bankrupt and non-bankrupt units a year before the phenomenon of bankruptcy is:

Log (y)tr = 2.064 + 0.066R2 + 0.233R7 – 0.913 R11 – 0.023 R15 – 1.205 R21

Statistical significance of variables

		B	S.E.	Wald	df	Sig.	Exp(B)
	R2	0.066	0.164	0.162	1	0.688	1.068
	R7	0.233	0.298	0.614	1	0.433	1.262
	R11	-0.913	0.25	13.393	1	0	0.401
	R21	-1.205	1.154	1.089	1	0.297	0.3
	R15	-0.023	0.059	0.149	1	0.699	0.978
	Konstante	2.064	0.875	5.562	1	0.018	7.875

Source: Author calculator

8. Conclusions

After we compared the predictive ability of the models, back to testing the hypothesis raised at the beginning of the study. For the first and second hypothesis, both models are evaluated by statistical tests. As seen during the construction of models, both models were statistically significant, they were so statistically valid, statistical indicator p (sig) = 0.000 For the third hypothesis testing used a test-t, given that the number of units in the study is small. In sum is the final hypothesis:

Ho3: the percentage classification accuracy in discriminating multiple model = the percentage accuracy in classification logit model

HA3: the percentage accuracy in classification model of multiple discrimination ≠ the percentage accuracy in classification logit model

Using SPSS 21 statistical program was compared to calculate the actual value of the critical value t, and with a 95% confidence level, the hypothesis of equality of percentage of forecast models accuracy rejected. So it is concluded that the constructed models have different abilities predictive phenomenon of bankruptcy.

For the fourth hypothesis testing studied functions obtained from each of the models. As noted from the survey results that hypothesis falls below because these functions contain financial statements that have coefficients and their corresponding sign positive or negative, indicating their ability predictive classification of the phenomenon of bankruptcy for commercial units in district Elbasan.

Liquidity ratios are important indicators of the financial position of the entity and have high skill in predicting the phenomena of their bankruptcy. According to the model otherwise the quick ratio or acid test resulted in higher classification capability that the liquidity of reports. Quick ratio is a financial indicator that is calculated as the ratio of the difference between the current assets inventory, the current liabilities of the unit.

The second important report on the classification of the unit function is turnover ratio of total assets. This indicator is calculated as the ratio of net sales to total assets of the company. He shows how successful a trading unit in the use of total assets for generating income from the sale.

In this report includes all assets as circulating and stable, inventory, accounts receivable, and any other active current, as well as equipment, machinery, vehicles, buildings, land, etc... The lower this ratio compared with previous years or compared with industry data, the lower are trading unit sales. Head of trading unit must analyze all asset classes to determine which of the assets or stable circulation causes reduction of this indicator.

Commercial units tend to have a higher value of this ratio due to the pricing policy, positioning in the market at competitive prices. A high turnover ratio of total assets is expected to have a high return on assets (ROA) and low risk of bankruptcy for commercial units. A high turnover ratio of total assets bring economic growth rate, ie the ratio of profitability stimulates indicator that determines the level of ROA model Du Pont (Liesz, 2002).

Determining the classification of trading on bankrupt entities and is not bankrupt and turnover ratio of receivable accounts. It is calculated as the ratio of net sales on receivables unit. By this indicator measured the ability in which trading unit manages to collect the money from sales made with subsequent collection of his clients.

The calculation is performed on the assumption uniformity of sales, and cash collections during the year. A long period of collection means a commercial loan use at high levels, resulting in liquidity problems, causing financial problems this way trading units. This indicator is an important signal to the phenomenon of bankruptcy and commercial units

especially since the bulk of their sales receipts later performed.

Higher probabilities of insolvency events are characteristic of commercial units with long periods of collection of accounts receivable. This result derived from the study is consistent with theories discussed in various literatures. Long periods of collection customers bring higher value of accounts receivable in the financial, commercial unit needs additional sources of financing of its activities, we extend the operating cycle, causing a negative impact on cash flows. This brings the growth of insolvency of trading unit, directing it toward bankruptcy.

Another report determining the classification of trading on bankrupt entities and is not bankrupt the debt ratio which is calculated as total liabilities to total equity unit. This report shows that the unit çpjesë assets financed with own resources and çpjesë financed with resources borrowed. The debt ratio is a key indicator for judging the financial position of the entity, and the entity's ability to repay its obligations. He is known as the financial leverage ratio.

A high ratio of financial leverage is an indication that the unit may not have enough likuidetete for repayment of its obligations. But on the other hand a low use of financial leverage is not an indication that the unit is using the advantages of increased profits that can bring financial leverage. The higher the financial leverage of the units, the higher is the probability of the phenomenon of bankruptcy. So this report is positively associated with the phenomenon of bankruptcy.

The latest report determining the classification of commercial units in bankrupt and not bankrupt by logistic regression function is the ratio of return on business assets, ROA. This ratio is calculated as total net profit of the unit on its total assets. ROA ratio shows the rate of return for a monetary unit invested in the assets of the unit. A high value of this report is indicative of a good financial situation healthy unit. Usually this ratio is higher for older units, well positioned in the market, rather than new units, newly established in the market. This is one of the financial ratios included in the model and the Altman Z-Score. A negative value of ROA is a signal that the unit is not successful trading and may go bankrupt. So the higher the ROA be financial ratio, the lower is the risk of bankruptcy for the trading unit.

By studying literature suggested as appropriate to use financial report ROA in predicting the phenomenon of bankruptcy compared with ROE financial report. If trading unit has negative equity and negative profits, in case of loss, these values mathematically provide a positive ROE ratio, while the ROA does not happen because the unit can not be active with negative value.

The five financial ratios mentioned above are decisive for the classification of commercial units in the unit of bankrupt and non-bankrupt unit by logistic regression model and a year before the bankruptcy phenomenon. But as noted above these are not the only financial reports that analysts should focus on the success of an entity. But their combination of accuracy in this study gave the highest ratings to selected units in the study. To judge about the situation financier of an entity must be taken into account and other financial reports, they are indicators of the financial performance of the unit. Combining these functions discriminatory financial reports in previous years, although it gives lower classification accuracy, the signal is likely that the entity could go into bankruptcy.

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