# A PREDICTION MODEL FOR THE ROMANIAN FIRMS IN THE CURRENT FINANCIAL CRISIS

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**Abstract:**
*The study consists in gathering the financial information for a group of listed companies, in difficulty and economically viable, in 2007-2008, in order to create the warning signals for financial companies in difficulty using econometric linkages between indicators. For each company, we consider a set of 14 financial indicators, which reflect the company's profitability, solvency, asset use, company size, were calculated and then used in the study. Analysis of links between financial indicators was used to allow comparison, seeing that the two types of companies distressed and viable are two distinct groups, suggesting that the rates used are sufficiently useful to predict subsequent financial difficulties.*

**Keywords:** prediction bankruptcy, financial indicators, listed company

**JEL Classification:** C10

## INTRODUCTION

The study consists into collection of the financial information for a group of listed companies in difficulty and economically viable in the period 2007-2008, in order to create early warning signals for financial companies in difficulty using the following econometric methodology principal components analysis and subsequent, multivariate discriminant analysis. For each company, it is considering a set of 14 indicators, which reflect the company's profitability, solvency, asset use, and size of company, were calculated and then used in the study. Principal components analysis was also used to reduce the dimensionality of data space and to allow comparisons, seeing that the two types of companies viable and in difficulty are two distinct groups suggesting that the rates used are sufficiently useful for anticipate further financial difficulties.

The following three sets of data were analyzed separately:

- First year data to predict the difficulties a year in advance
- The second year, given the difficulties to predict two years in advance
-And two-year cumulative data to predict the danger of bankruptcy with a year earlier.

Taking this into account, the purpose of this paper is to collect financial information for a group of Romanian companies in difficulty and viable listed in RASDAQ market in 2007-2008, for which data were available, in order to create early warning signals for companies in difficulty using several types of models and methodologies, which were chosen based on results of similar studies. Since the bankruptcy prediction has been extensively studied for several decades, many methodologies were quite accurate in forecasting its results.

For this study, public financial informations for 2007-2008 were collected from sites on the Bucharest Stock Exchange and the Ministry of Finance. The sample consisted of 100 companies listed on RASDAQ, with similar characteristics were included in the same category III-R market. The choice of this sample from a total of 1645 companies listed on RASDAQ was made in order to have two equal groups of companies "insolvent" and "viable", as well as most previous studies of bankruptcy prediction.

A company with financial difficulties indicates that its obligations to its creditors are honored with difficulty or not at all, and even then it can lead to bankruptcy. Since there is no standard definition for classifying companies into "bankruptcy" and "viable", however, is more difficult to decide which companies to classify the reasons therefore, only the simple case of a company in bankruptcy or non-bankruptcy , the status is pretty obvious, but for non-financial data are less available. Referring to other similar studies for companies in difficulty, however, Yanhui Zheng (2007), Psillaki, Tsolas and Margaritis (2008)), we followed the same main criteria for appropriate classification of companies. Therefore, a company was considered "failing" if it had losses and arrears for at least two consecutive years.

Following this classification rules, there were 55 Romanian companies in difficulty in 2008 in RASDAQ market, of which 50 have all necessary information for all years 2007-2008. To summarize, to have two equal groups of companies in ,,difficulty" and ,,viable" for this study were chosen 50 companies in difficulty, for which financial information was available and 50 other companies viable, similar in terms of asset size and industry, who were chosen at random.

As noted in Scott (1981), many of the variables that were most frequently used in empirical analysis does not withstand to a strong analysis, but their use is primarily on their popularity in the literature and the success of prediction in previous research. Thus, the selection of main financial indicators set for this study was based on previous results presented in the literature, but also limited to financial data provided by the Bucharest Stock Exchange and the Finance Ministry. Therefore, there were 14 indicators calculated for the purpose of this study and grouped into four distinct categories, reflecting the company's profitability, solvency, asset utilization, and size. The definition of each of the 14 indicators is presented in the table below.

As we noted, some financial indicators have been transformed through the application of natural logarithms, while others are expressed in percentages. The aim was to bring all values to a similar scale.

The profitability is represented by the *profit margin* (I1), calculated as net profit or net loss divided by turnover, return on assets *ROA* (I2), calculated as the ratio between net profit and total assets, return on equity *ROE* (I3), which is the ratio net profit of total equity and, *profit per employee* (I4) and *operating income per employee* (I5). All these indicators are common measures of financial performance management and, therefore, are vital in the study of financial bankruptcy.

Getting a higher rate of profit is an objective to be pursued by any enterprise manager. The profit rate shows the net result for the combined effects of liquidity, asset management and debt management. Economic rate of return (ROA) is the rate of return on all capital raised it from its owners and creditors. Return on capital invested by owners (ROE) is the largest rate of a firm depending on its value as shareholders decide whether to invest or withdraw from a deal.

Ohlson (1980), Lennox (1999) and Zulkarnain (2001) showed that profitability is an important factor in determining firms in difficulty. It is expected that firms with high returns have a lower likelihood of bankruptcy. Therefore, the relationship between them is negative.

| **Financial indicators** | | |
|---|---|---|
| **I1** | **profit margin** | net profit / turnover * 100 |
| **I2** | **ROA** | net profit / total assets * 100 |
| **I3** | **ROE** | net profit / total capital * 100 |
| **I4** | **profit per employee** | net profit / employees |
| **I5** | **operating income per employee** | ln (operating income / employees) |
| **I6** | **current rate** | current assets / current debts |
| **I7** | **debt capital** | total debt / total capital * 100 |
| **I8** | **debt on total assets** | total debt / total assets * 100 |
| **I9** | **working capital per employee** | working capital / employees |
| **I10** | **total assets per employee** | ln (total assets / employees |

| | | |
|---|---|---|
| **I11** | **size** | ln (total assets) |
| **I12** | **rotation speed of stocks** | turnover / stocks |
| **I13** | **debt collection speed** | Clients / daily sales |
| **I14** | **rotational speed of Total Assets** | turnover / total assets |

The borrowing is also an important element to be analyzed because it measures a company's ability to meet its financial obligations, thereby avoiding corporate failures. Financial indicators are the *current rate* (I6), calculated as the ratio between current assets and current liabilities, *debt capital* (I7), which is calculated as total debt divided by total capital, *debt on total assets* (I8), calculated as total debt divided by total assets.

The current ratio, defined as general liquidity, indicates the extent to which short-term creditors' rights are covered by the value of assets that can be converted into cash when needed. This indicator measures the volume of external financing compared to that of financing provided by owners. As its value is greater, the more your business depends more on its creditors, and the higher risk associated with (as all liabilities on company balance granting rights to third parties). A high ratio implies a high risk for creditors. They will take into account the current banking rules and regulations. Usually an acceptable value for most of the activity is <0.5. A small report demonstrates the company's ability to increase their volume of loans, subject to a corresponding cash flow (which would allow future debt service pay).

The last, explain to what extent a company relies on debt financing rather than equity and provide information on a company in insolvency and its ability to secure additional financing for good investment opportunities. This indicator is to ensure that creditors are protected in the future.

Debt ratio is a general indicator of borrowing and is calculated as the ratio between total liabilities and total assets. Normally, the debt ratio should be less than or equal to one, from the idea that the volume of debts must be less than or equal to the total value of assets.

Another aspect of the economic activity of a company is described on how assets are used. This can be measured by financial indicators such as *working capital per employee* (I9), and *total assets per employee* (I10).

Another factor that appears to discriminate between companies is size, which is measured as the natural logarithm of *total assets* (I11). Large companies normally have a large base of assets compared to smaller companies. Ohlson (1980) found that size was a significant factor in viable companies into bankruptcy. It is expected that the relationship between these two variables is negative, the larger the size of a company, the more likely than distress or even bankruptcy.

How effectively the firm uses the assets available to continue to be of concern to financial managers, to ensure a certain balance between turnover and the firm's assets. In our analysis, three indicators are used to determine the efficiency with which assets are used: *rotation speed of stocks* (I12),

the control of size and value of the stocks is one of the keys to success in business: a company cannot work without the stocks, yet too many stocks can result in a financial jam immobilizing the money with which they were purchased; *debt collection speed* (I13) shows the number of days between the time of delivery of goods, works and that of their payment being received and *rotational speed of Total Assets* (I14), measures the efficiency with which the company uses the machines and equipment available.

## THE ANALYSIS RESULTS

Several prediction models and methodologies have been used in model search which has the best precision sample and identify the financial indicators that are most relevant in predicting bankruptcy. The study was divided into two main parts, therefore, the main types of

methods and methodologies used. Each part focuses on the following data sets separately:
- The first year, when financial reports are only used 2008 to anticipate financial problems a year earlier
- The second year, when using only financial ratios of 2007 to predict financial problems two years before
- And two-year cumulative data, when using all financial reports for 2007-2008 to predict financial problems a year earlier.

For each of the four sets of data, descriptive analysis was done to be better informed about the nature of correspondence between all 14 variables differences in average for each of the two types of companies, and any other features that may become useful in studying prediction.

## DESCRIPTIVE STATISTICS

First, the average values of each of the 14 indicators for both types of companies in difficulty and viable were calculated and presented in the tables below.

First we notice that the indicators of profit margin, ROA, ROE, and profit per employee of companies in difficulty have negative values for all data sets considered and, therefore, as expected, lower than those of viable companies.

Moreover, it appears that companies in difficulty is based more on debt, compared to approximately 2.148708 debts to total assets compared to only 0.96 viable businesses when considering the first year and by 2.04 for companies in difficulty, compared to 0.91 when using second-year data set, only 2.09 compared with 0.92 when using panel data aggregated over two years.

| | **Viable** | | **Difficulty** | |
|---|---|---|---|---|
| **2007** | **Mean** | **StDev** | **Mean** | **St Dev** |
| **I1** | 10.82479 | 11.38512 | -34.45628 | 40.40124 |
| **I2** | 8.25948 | 6.327937 | -17.0408 | 15.55741 |
| **I3** | 13.21857 | 10.31793 | -68.5923 | 130.6802 |
| **I4** | 19218.63 | 21786.24 | -21299.44 | 25995.44 |
| **I5** | 12.06727 | 0.800222 | 11.21147 | 0.940313 |
| **I6** | 2.718859 | 2.845516 | 0.790733 | 0.624125 |
| **I7** | 0.869944 | 0.885322 | 8.348254 | 34.72631 |
| **I8** | 0.969296 | 1.017546 | 2.148708 | 3.527405 |
| **I9** | 153960.0824 | 428024.4795 | 79237.22359 | 188920.0552 |
| **I10** | 12.06851 | 0.941081 | 11.5934 | 1.050876 |
| **I11** | 18.35842 | 1.41169 | 17.06504 | 1.4854 |
| **I12** | 72.72488 | 119.3099 | 137.4066 | 156.2796 |
| **I13** | 65.25417 | 49.1016 | 137.4168 | 189.5652 |
| **I14** | 2.15978 | 8.352594 | 2.178537 | 3.557583 |

Other indicators recorded big differences between the values of financial ratios for companies in difficulty and viable are the speed of rotation of stocks (72.72 compared with 137.4 in the first year, 73.4 compared with 260 the second year and 74.29 compared with 196.99), speed collection of receivables (65.25 compared with 137.41 the first year, 67.12 compared with 404.56 the second year, 67.28 compared with 271.41 for the two years combined).

| | **Viable** | | **Difficulty** | |
|---|---|---|---|---|
| **2008** | **Mean** | **StDev** | **Mean** | **St Dev** |
| **I1** | 9.97103 | 10.627 | -43.658 | 56.8396 |

| | | | | |
|---|---|---|---|---|
| **I2** | 7.61864 | 6.811976 | -18.749 | 14.90872 |
| **I3** | 11.16147 | 9.52645 | -48.7624 | 45.89776 |
| **I4** | 23009.19 | 28002.60 | -35526.45 | 45897.95 |
| **I5** | 12.2842 | 0.845462 | 11.35644 | 1.045958 |
| **I6** | 3.772982 | 6.022482 | 0.706671 | 0.659681 |
| **I7** | 0.89034 | 1.135865 | 7.477664 | 18.30257 |
| **I8** | 0.910566 | 1.009141 | 2.043756 | 2.835615 |
| **I9** | 189864.3523 | 415153.9754 | 125523.2265 | 371182.8428 |
| **I10** | 12.32601 | 1.000133 | 11.88447 | 1.158533 |
| **I11** | 18.58411 | 1.368526 | 17.02965 | 1.494515 |
| **I12** | 73.40595 | 100.3051 | 260.3918 | 706.8726 |
| **I13** | 67.12583 | 46.26435 | 404.5692 | 1765.453 |
| **I14** | 1.147772 | 1.845883 | 1.822412 | 2.457775 |

| | **Viable** | | **Difficulty** | |
|---|---|---|---|---|
| **Cumulative** | **Mean** | **StDev** | **Mean** | **St Dev** |
| **I1** | 10.3979 | 10.2424 | -39.057 | 40.7396 |
| **I2** | 7.93906 | 5.18239 | -17.8949 | 12.2739 |
| **I3** | 12.1900 | 8.08787 | -58.6773 | 78.6023 |
| **I4** | 21113.9 | 23804.1 | -28412.9 | 31108.8 |
| **I5** | 12.1757 | 0.81337 | 11.2839 | 0.94135 |
| **I6** | 3.24592 | 3.94737 | 0.74870 | 0.61110 |
| **I7** | 0.88014 | 0.94557 | 7.91295 | 24.2853 |
| **I8** | 0.93993 | 0.9602 | 2.09623 | 3.07112 |
| **I9** | 170621.6648 | 416151.5714 | 101846.9588 | 276379.5889 |
| **I10** | 12.1818 | 0.96989 | 11.7585 | 1.07799 |
| **I11** | 18.4624 | 1.37803 | 17.0388 | 1.47403 |
| **I12** | 74.2933 | 108.251 | 196.996 | 374.435 |
| **I13** | 67.2850 | 47.0314 | 271.410 | 914.135 |
| **I14** | 1.76326 | 4.67461 | 1.86402 | 2.68270 |

Another indicator that has extremely low values for companies in difficulty is the current rate, for the first year compared 2.71885914 to 0.79, for the second year compared with 3.77 0.70, 0.74 years compared with 3.24 for cumulative years.

Average firm size indicator values are quite close between viable companies in difficulty, for all tables (18.35 compared with 17.06 for the first year, showing that both companies in difficulty and in need of non-original sample was chosen for reasons well of similarity.

The following table shows the univariate analysis to identify the financial indicators that have the greatest ability to differentiate between companies with the difficult financial situation and viable for all three tables.

The results show that financial indicators, with a significant difference at 0.05% for 2007 are: profit margin (I1), ROA (I2), ROE (I3), the current rate (I6), liabilities total assets (I8), size of company (I11) stock rotation speed (I12) and debt collection speed (I13).

| | **Viable** | **Difficulty** | **Mean differences** | |
|---|---|---|---|---|
| **2007** | **Mean** | **Mean** | **t-statistic** | **sig** |
| **I1** | 10.82479 | -34.456282 | 7.320 | .000 |
| **I2** | 8.25948 | -17.0408 | 10.856 | .000 |
| **I3** | 13.21857 | -68.5923 | 4.368 | .000 |
| **I4** | 19218.6349 | -21299.44 | 8.793 | .061 |
| **I5** | 12.06727 | 11.21147 | 4.833 | .078 |
| **I6** | 2.71885914 | 0.790733 | 4.748 | .000 |
| **I7** | 0.869944 | 8.348254 | -1.522 | .135 |

| | | | | |
|---|---|---|---|---|
| **I8** | 0.969296 | 2.148708 | -2.233 | .030 |
| **I9** | 153960.0824 | 79237.22359 | 1.992 | .052 |
| **I10** | 12.06851 | 11.5934 | 2.270 | .088 |
| **I11** | 18.35842 | 17.06504 | 5.752 | .000 |
| **I12** | 72.72488 | 137.4066 | -2.085 | .042 |
| **I13** | 65.25417 | 137.4168 | -2.502 | .016 |
| **I14** | 2.15978 | 2.178537 | .364 | .718 |

In 2008, the financial indicators discovered in previous year remain the same, with the observation that stocks variable rotational speed disappears, the sig is higher than 0,005.

| | **Viable** | **Difficulty** | **Mean differences** | |
|---|---|---|---|---|
| **2008** | **Mean** | **Mean** | **t-statistic** | **sig** |
| **I1** | 9.97103 | -43.658 | 6.446 | .000 |
| **I2** | 7.61864 | -18.749 | 11.153 | .000 |
| **I3** | 11.16147 | -48.7624 | 8.171 | .000 |
| **I4** | 23009.19616 | -35526.4524 | 7.555 | .000 |
| **I5** | 12.2842 | 11.35644 | 4.959 | .000 |
| **I6** | 3.772982 | 0.706671 | 3.676 | .001 |
| **I7** | 0.89034 | 7.477664 | -2.526 | .015 |
| **I8** | 0.910566 | 2.043756 | -2.886 | .006 |
| **I9** | 189864.3523 | 125523.2265 | 2.323 | .024 |
| **I10** | 12.32601173 | 11.8844782 | 2.259 | .028 |
| **I11** | 18.58411075 | 17.02965529 | 6.627 | .000 |
| **I12** | 73.405954 | 260.391882 | -1.870 | .067 |
| **I13** | 67.12583 | 404.569284 | -1.357 | .181 |
| **I14** | 1.147772 | 1.822412 | -1.500 | .140 |

The financial indicators, with a significant difference at 0.05% for the years 2007-2008 (combined) are: profit margin (I1), ROA (I2), ROE (I3), profit per employee (I4), the current rate (I6), debt capital (I7), liabilities total assets (I8), company size (I11) stock rotation speed (I12) and debt collection speed (I13).

To conclude, these are significant differences for each of the three data sets:

- First-year data set: I1, I2, I3, I6, I8, I11, I13 and I12
- Second-year data set: I1, I2, I3, I6, I8, I11 and I13
- Two-year cumulative data set: I1, I2, I3, I4, I6, I7, I8, I11, I13 and I12

| | **Viable** | **Difficulty** | **Mean differences** | |
|---|---|---|---|---|
| **Cumulative** | **Mean** | **Mean** | **t-statistic** | **sig** |
| **I1** | 10.397911 | -39.057 | 7.964 | .000 |
| **I2** | 7.93906 | -17.8949 | 13.629 | .000 |
| **I3** | 12.19002 | -58.677366 | 6.172 | .000 |
| **I4** | 21113.91552 | -28412.94622 | 8.866 | .000 |
| **I5** | 12.17574 | 11.28395 | 5.086 | .000 |
| **I6** | 3.245921 | 0.748702 | 4.588 | .000 |
| **I7** | 0.880142 | 7.912959 | -2.041 | .047 |
| **I8** | 0.939931 | 2.096232 | -2.582 | .013 |
| **I9** | 170621.6648 | 101846.9588 | 2.512 | .015 |
| **I10** | 12.18181072 | 11.75854339 | 2.311 | .025 |
| **I11** | 18.46244042 | 17.03885258 | 6.246 | .000 |
| **I12** | 74.293317 | 196.996441 | -2.261 | .028 |
| **I13** | 67.285048 | 271.410633 | -1.594 | .117 |
| **I14** | 1.763264 | 1.864023 | -.128 | .899 |

## CONCLUSIONS

Through this article we try to identify which financial indicators are important in the construction of a bankruptcy function for the Romanian companies. Applying traditional models (Altman, Beaver, Conan Holder) in Romania does not automatically lead to expected results, due to their specificity: market analysis, its characteristics, financial ratios used. The importance of this study is the discovery of important financial indicators for companies in Romania. Future extensions of this study may include the use of discriminant analysis for discovery of predictive functions for bankruptcy.

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