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*Full Length Research Paper*

# Early warning model with statistical analysis procedures in Turkish insurance companies

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**In this study, we have developed and tested a statistical early warning model to identify companies experiencing deteriorating financial health by examining 45 insurance companies acting in non-life elementary branches of insurance during the period between 1992 and 2006. We developed the model using data regarding 45 dependent and 17 independent variables and logit model. The present study extends previous analyses by using relatively more comprehensive accounting data in logit analysis. This study compared the ability of logit, discriminant and regression analyses to predict insurance company underperformance. The same model, comprised of identical variables, was obtained as the result of the multiple regression and multiple discriminator methods. When comparing the predictive ability of all three models, the logit model showed slightly better prediction ability than the other models. The three models used information from 2003 - 2006 to predict the performance of insurance companies in 2007. The research demonstrates that logit analysis has a strong potential.**

**Key words:** Insurance companies, early warning, discriminator analysis, regression analysis, financial failure, financial non-failure, financial analysis.

## INTRODUCTION

Insurance companies are social entities organised to offload the financial risks encountered by individuals or firms. Individuals pay a premium and given the occurrence of specific events, receive remuneration for losses incurred. In addition, insurance companies contribute substantially to the national economy by using capital gathered through premiums for investment. Insurance companies have the ability to remedy socio-economic crashes stemming from the failure of enterprises due to economic disasters in addition to securing funds and reinvesting in the national economy.

The high potential for insurability and the rapid improvement of the insurance and pension sector have increased the visibility of the Turkish insurance market to foreign investors. Since the insurability rate has reached a saturation point in other countries, foreign investors began increasing their investments in developing countries beginning in 2006, with this investment continuing to grow in 2007. To further increase the efficiency and efficacy of the national insurance sector, it is very important to examine and analyse the sector data.

Company profitability trends attract not only the attention of the shareholders, but also the attention of investors, creditors and auditing firms. Business failure is an unfavourable and costly event for society. In an environment with limited resources, business failure can mean the misallocation of resources and result in enormous economic and social costs. When a firm goes bankrupt, shareholders are usually the biggest losers.

Operations such as measuring, evaluating and rating should be performed in order to better assess an insurance company's financial potential. A trustworthy flow of income to the market, which might allow for increases in decision speed and quality, may be possible with the implementation of rating applications. In addition, the development of increasingly sophisticated computer technologies has enabled the use of statistical methods in several research fields.

In a similar study, İşseveroğlu (2005), aimed to develop

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a multi-variable model to predict the starting period of financial failures or difficulties for enterprises by applying multi-dimensional statistical analyses to the Turkish insurance sector and defining factors causing financial failure.

Our data set has been compiled from the financial statements of 45 Turkish insurance companies. We developed our model using data about 45 dependent and 17 independent variables and employed multiple regression and multiple discriminator techniques. The same model, using identical variables, was obtained as the result of the two analyses. The exact predictive power of the five financial ratios obtained through the multiple regression model was 93, 89 and 87% for the first, second and the third years, respectively. The multiple discriminator method was then run using the same data and the results were compared with those of the multiple regression method and the model was then run using the stepwise method, the same financial ratios of the regression model were also obtained in the discriminator model. Financial ratios, being the same in both models, demonstrated that they had an important differentiation power in classifying enterprises. The multiple discriminator models' power to predict enterprises' financial successes and failures in the preceding 1, 2 and the 3 years was 100, 94 and 81%, respectively.

The validity of the model we have developed could be tested during the study by integrating data from 2003 and 2004. Fourteen companies emerged with early warning signals in both models based on data from 2003. The analysis carried out with 2004 data showed six companies emerging with warning signals in the second year. Four companies out of these six left the sector according to information issued by the Under Secretariat of Treasury. The study demonstrated that the results obtained in the developed models are applicable to the present time.

In this study, the performance obtained with the multiple discriminator and the multiple regression models are compared. The accuracy of the foresight models made earlier by logit analysis, a statistical method, will be tested once more. It will be determined if a similar benefit would be obtained using the methods described when applied to 2005 - 2006 data. In addition, the employability of the foresight model will also be assessed by adding the data from the years 2005 and 2006.

## FINANCIAL SUCCESS OR FAILURE PREDICTION MODELS WITH FINANCIAL RATIOS

The first and the most cited research in the literature on this topic is the 1966 study by Beaver (1966). Beaver measured the power of financial ratios and came to the conclusion that they might be used in predicting the enterprise's failure. The purpose of his earlier study was to determine how well financial ratios could predict failure relative to random prediction. The findings of the study demonstrated that the financial ratios predicted the failure status of firms to a much greater extent than would be expected from random prediction. For example, one year before failure, the cash flow to total debt ratio misclassified only 13% of the sample firms. Five years before failure, the same ratio misclassified only 22%. Since there were an approximately equal number of failed and non-failed firms in the sample, the expected error from random prediction was approximately 50%. There was thus, an extremely small probability that random prediction could have done as well as the ratio (Beaver, 1968). This analysis suggested that financial ratios could be useful in the prediction of failure up to five years prior to the event.

Edward I. Altman, a primary contributor to the financial failure literature, chose 33 successful and unsuccessful enterprises by random sampling during the period of 1946 through 1965. Financial data covering a period of five years and 22 financial ratios were analysed. Five financial ratios best measuring the financial power were obtained as a result of linear differentiation analysis. A discriminant function with a linear combination of five ratios was derived from data one year prior to bankruptcy. Called the Z-model, this model was derived using the previously mentioned five ratios and the differentiation score. It was calculated as follows:

$$Z = 0.12X1 + 0.14\ X2 + 0.33\ X3 + 0.06\ X4 + 0.999\ X5$$

As high as 94% of unsuccessful enterprises and successful enterprises with 97% accuracy ratios were correctly classified for the first year preceding the failure. Unsuccessful enterprises were classified with 72% exactitude for the second year before the failure, 48% for the third year, 29% for the fourth and 36% for the fifth year consecutively. However, the accuracy of classification declined rapidly as the number of years prior to failure increased. The model has been found to be predictive, albeit with diminishing exactitude, as one moves earlier in time.

Thus, additional refinement of Altman's model is required to improve the accuracy of earlier year prediction. Finally, Altman examined the predictive validity of the model on a new sample, consisting of 25 bankrupt firms and 66 non-failed firms in the same period as the initial sample. The result indicated 96% of bankrupt firms and 79% of non-bankrupt firms were correctly classified one year prior to bankruptcy.

Altman was the first to use MDA to develop a failure prediction model. Altman obtained the ZETA model by developing his first Z model in 1993 (Altman, 1993). Since that time, the MDA method has been extensively used in business failure prediction studies. He compared 53 enterprises that went bankrupt and 58 enterprises that did not instead of classifying enterprises as successful or

unsuccessful in the ZETA model. From this, he obtained seven significant financial ratios. Exactitude ratios of 95% in the first year preceding the failure, 87% in the second, 75% in the third, 68% in the fourth and 64% in the fifth year were demonstrated. Altman also proved in his study, using quadratic discriminator analysis and linear discriminator analysis, that there was not a great difference in exactitude in classifying groups.

Deaken, by analyzing 32 firms, matched each failed firm with a non-failed firm according to industry and size in the period 1964 - 1970. Deakin's model correctly classified 97, 95 and 95% for the first three years prior to failure, respectively (Deaken, 1972). In a sample of 63 bankrupt and 80 non-bankrupt enterprises during the period 1966 - 1971, Deaken (1977) employed multiple discriminator analysis using both linear and quadratic forms to classify enterprises with a 94% exactitude ratio in the linear and 84% in the quadratic model, respectively.

Edmister (1972), in a study consisting of 21 failed firms and 21 non-failed firms during the period of 1954 - 1969, classified enterprises who borrowed from the organisation called “Small Business Administration Ration” and still lost as unsuccessful (failed) and those enterprises that did not lose were classified as successful (non failed). Edmister developed a predictive model for one year before failure and with a cut-off point of 0.52. He found the classification accuracy of the model for one year prior to failure to be 93%.

Blum (1974), constructed a failing company model with discriminant analysis to assess the probability of business failure during the period from 1954 to 1968. Blum’s study includes 115 successful (non-failed) and 115 unsuccessful (failed) enterprises. The firms were matched on the basis of industry, sales, number of employees and fiscal year. Blum calculated a cutoff point to discriminate between failed firms and non-failed firms. His model had the overall classification accuracy of 94% for the first year preceding the failure, 80% for the second year and 70% for the third year.

## LOGIT ANALYSIS

Logistic regression analysis is one alternative developed in response to the limits of MDA. MDA is modestly successful in classifying failure and non-failure, but there are validity problems with the application of this method in failure prediction studies. One of these problems is that each individual variable must be normally distributed under MDA. Eisenbeis (1977), identified another problem: the coefficients of individual variables in the discriminant function are not meaningful and it is impossible to determine the significance of explanatory variables in the model.

Logit analysis has several advantages over MDA. The first of these is that the method is more robust and reliable since the normality assumption for ratio variables is not required.

In addition, instead of a composite score for the dependent variable in MDA, the dependent variable in a logit model falls within a (0, 1) distribution. Using a probability distribution to explain potential failed firms is generally thought to be a superior methodology in failure prediction research. Moreover, the coefficient of an individual variable in a logit function is interpretable and the significance of a variable can be tested statistically. As a result, each financial ratio in a failure prediction model is examined so that the predictive ability of the model can be improved.

Ohlsonee (1980) was the first to use logit analysis to assess the probability of corporate failure. He obtained 105 publicly traded industrial firms that went bankrupt during the period 1970 to 1976 and 2,058 nonbankrupt firms during the same period. Ohlson developed three logit models for each of the three years prior to bankruptcy. The results indicated that that the coefficients of six variables reached levels of statistical significance in all three models. The logit function showed 84% for the model one year before bankruptcy and was statistically significant. Ohlson selected a cutoff point of 0.038. Ohlson's model misclassified 17.4% of non-failed firms as failed firms, and 12.4% of the bankrupt firms as non-failed one year before bankruptcy.

Zavgren et al. (1985) studied 45 failed firms which went bankrupt during the period 1972 - 1978. Each bankrupt firm was matched with a non-bankrupt company in terms of industry and asset size. Zavgren developed five models from data in each of the five years before failure and found that all models for five years were significant. ($p < .05$). The results indicated that models were able to clearly distinguish between failed firms from non-failed firms. The overall error rates of prediction were 18, 17, 22, 27, and 20% for the five years before failure.

Platt and Platt’s (1990) sample in the study consisted of 57 failed firms and 57 non-failed firms. The firms were matched by asset size and industry membership in the period of 1972 to1986. The results indicated that the logit model accurately classified 90% of the firms a year before bankruptcy, including 93% of failed firms and 86% of non-failed firms.

## THE APPLICATION OF FINANCIAL FAILURE PREDICTION MODELS ON COMPANIES

### Objective of the research

The purpose of this research is to compare the logit analysis with the ability of multiple discriminator analysis and multiple regression analysis to utilise financial data to predict insurance firms’ underperformance. Leading development in our insurance sector is that Turkish Insurance Law came into force in June, 2007. Insurance Law has been prepared in accordance with EU norms and needs of individuals, corporations and institutions. To develop and execute the national insurance sector on such a scientific basis, it is very important to acquire and analyse the sector data

**Table 1.** Success / failure distribution of insurance companies by years.

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Non-failed | 38 | 38 | 38 | 39 | 37 | 39 | 39 | 39 | 39 | 36 | 34 | 32 | 2 |
| Failed | | | | 1 | 5 | | | | | 3 | 2 | 2 | |

reliably.

Some technical and format changes to the financial statements of the insurance companies have been made to bring processes in line with those of the European Union. The logit analysis was applied after it was determined that these changes did not affect the existing models.

**Scope of the research**

McGurr and DeVaney (1998)... contended that, because the financial characteristics of firms were different among each industry, a bankruptcy prediction model estimated by sample firms from various industries would be less successful in discriminating between bankrupt and non-bankrupt firms for a single industry.

Different methods are adopted to evaluate the financial viability of companies in different sectors. It is quite difficult to evaluate the financial viability of an industrial company and an insurance company with the same methods. The importance of financial ratios in differentiating non-failed companies from failed ones may vary to a great extent in various sectors. We assumed that a sector-specific study of the insurance sector has different financial statements when compared with those of standard statements for publicly held commercial and industrial corporations. This was determined based on the Notices of Capital Markets Board and the results of the uniform accounting system reflecting “Technical Revenues”, “Technical Expenses”, “Financial Revenues” and “Financial Expenses” might empower the prediction capacity of an early warning model. Life insurance companies have some technical differences that are not included in the research in order to obtain homogeneous sample. Sampling included insurance companies merely active in non-life elementary branches.

Computable ratios may be theoretically defined with units of hundreds. The most commonly used and the easily computable ratios for the Turkish insurance sector were selected. This was due to the fact that insurance companies use different type of accounting relevant to their activities. Thus, the evaluation of company-specific ratios would have introduced significant variability across companies.

Insurance companies whose authorisation to provide new insurance or reinsurance was annulled or who was declared bankrupt by the Prime Ministry Under Secretariat of Treasury Insurance Supervisory Board was classified as “financially unsuccessful (failed) companies” in the study.

The data have been prepared with Excel, with data obtained from balance sheets and technical and financial income-loss statements of Turkish insurance companies acting in elementary branches of insurance during the period from 1992 to 2006. The dependent variable used in the analyses was defined by allocating “0” to companies that failed and or left the sector and “1” to those that were successful (non-failed) and still active.

Based on the data in Table 1, two companies entered the sector and one company failed in 1995. The year 1996 was not taken as the basis for analysis (though the most failures appeared in 1996) because a large number of entries are encountered in 1995, 1996 and 1997 and we wanted to increase the scope of data by including new companies. The Turkish economy faced a severe crisis in 2001, which affected the insurance sector. The year 2001 is therefore assumed to be the starting point for financial failures.

There were 32 insurance companies that were classified as non-failed in 2000. Forty-five companies in total, together with 13 companies that failed in different years are considered in the analysis (Table 2). The small number of companies failing within a given year precludes statistical analysis of failure within a given year. Thus, failures in different years are included in the data set and assumed to be failures occurring within the same year. We used the financial statements of companies for 1, 2 and 3 previous years. We then tried to develop a warning model predicting financial success / failure. With one exception, the year 2001 is taken as the basis year and 2000 data is used as the first preceding year, 1999 data for the second preceding year and 1998 data for the third preceding year for companies active in 2001. For the failed company, Dogan insurance firm, the 1994 financial statements were used for the first year, the 1993 financial statements for the second and the 1992 financial statements for the third year.

**Logit model**

The study aimed to develop a logit model that predicts which companies will fail based on the published financial statements of companies in the first, second and the third years preceding failure. A sample of 45 companies serve as dependent variables and 17 financial ratios serve as independent variables in the development of the logit model.

The first hypothesis has been tested to define whether all ratios utilised throughout the study are important in the prediction companies’ financial successes or failures.

$H_1$ = Financial ratios are statistically significant in predicting insurance companies financial successes / failures.
$H_0$ = Financial ratios are not statistically significant in predicting insurance companies financial successes / failures.

The second hypothesis was tested according to prediction power in predicting insurance companies’ financial successes / failures.

$H_2$ = There is not an important difference among the logit model, the multiple regression and the multiple discriminator methods in terms of prediction power of insurance companies’ financial successes / failures.
$H_0$ = There is an important difference among the logit model, the multiple regression and the multiple discriminator methods in terms of prediction power of insurance companies’ financial successes / failures.

The model’s early warning performance before companies’ failures has been measured through data obtained by the study. Hypothesis H2 appears valid with a 5% significance level, with all companies have been rated according to their yearly successes.

## RESULTS

The dataset containing 17 financial ratios of 45 insurance companies, 13 of which failed financially, has been analysed using the statistical software SPSS version 16.

**Table 2.** Unsuccessful companies in Turkey between 1992 and 2003.

| Company | Financial failure year |
|---|---|
| Doğan | 1995 |
| İmtaş | 1996 |
| Cigna-Sa | 1996 |
| Assatalia | 1996 |
| Prefoncıer | 1996 |
| Ruın Adretica | 1996 |
| Unıversal | 2001 |
| Inan | 2001 |
| Emek | 2001 |
| Bayindir | 2002 |
| Akdeniz | 2002 |
| Merkez | 2003 |
| EGS | 2003 |

**Table 3.** $H_1$ Hypothesis result with logit model.

| Classification table[a] | | | | | |
|---|---|---|---|---|---|
| Observed | | | Predicted | | |
| | | | BASRI | | Percentage correct |
| | | | 0.00 | 1.00 | |
| Step 1 | BASARI | 0.00 | 13 | 0 | 100.0 |
| | Overall percentage | 1.00 | 0 | 32 | 100.0 |
| | | | | | 100.0 |

a. The cut value is, 500

Financial Tables about the first, second and third years preceding the failure are used to test Hypothesis H1 (Tables 3 and 4). All 17 Financial ratios have been included in the logit model analysis for this purpose.

The model obtained by the logit analysis has rated companies with an exactitude ratio of 100% for the first, 100% for the second and 100% for the third year. The 100% prediction percentages show that Hypothesis H1 stating that "Financial ratios are statistically significant in predicting insurance companies financial successes/ failures." should be accepted (Tables 5 and 6).

Logit analysis has been used first to test the hypothesis that "There is not an important difference among the logit model, the multiple regression and the multiple discriminator methods in terms of prediction power of insurance companies' financial successes / failures".

Same financial ratios of the regression model and the discriminator model are obtained in the logit model as well (Table 7).

These ratios are the following:

X4: Shareholder's equity suitability ratio.

X9: Balance-sheet profit / shareholder's equity.

X11: Balance-sheet profit / total assets.

X12: Technical profit / premiums received.

**Table 4.** Model Summary

| Step | -2 Log likelihood | Cox and Snell $R^2$ | Nagelkerke $R^2$ |
|---|---|---|---|
| 1 | 0.000 | 0.700 | 1.000 |

X15: Technical profit / Total assets.

The model obtained in the study is as follows:

Y = -59,918 + 68,546*X4 + 232,480*X9 – 697,717*X11 – 8,639*X12 + 374,648*X15

The exact prediction powers of five financial ratios obtained through the logit model are 100, 93.3 and 82.2% for the first, second and the third years, respectively.

## The multiple discriminator vs. the multiple regression models

In the previous study, the stepwise method in the multiple regression analysis has been used. First to test the

**Table 5.** Variables in the equation.

| Step 0 constant | B | S.E | Wald | df | Sig. | Exp(B) |
|---|---|---|---|---|---|---|
| | 0.901 | 0.329 | 7.501 | 1 | 0.00 | 2.462 |

**Table 6.** Classification table.

| Observed | | | Predicted | | |
|---|---|---|---|---|---|
| | | | BASARI | | Percentage correct |
| | | | .00 | 1.00 | |
| Step 1 | BASARI | .00 | 13 | 0 | 100.0 |
| | | 1.00 | 0 | 32 | 100.0 |
| | Overall percentage | | | | 100.0 |

a. The cut value is .500

**Table 7.** Model obtained by the logit analysis, variables in the equation.

| | B | S.E. | df | Sig. | Exp(B) |
|---|---|---|---|---|---|
| X4 | 68.546 | 11896.319 | 0.000 | 0.000 | 5.9 |
| Step 1 X9 | 232.480 | 36271.635 | 0.000 | 0.000 | 9.22 |
| X11 | -697.717 | 131828.003 | 0.000 | 0.000 | 0.054 |
| X12 | | | 0.000 | 0.000 | 0.043 |
| X15 | -8.639 | 2990.431 | 0.000 | 0.000 | 5.1 |
| Constant | 374.648 | 56831.003 | 0.000 | 0.000 | 0.041 |
| | -59.918 | 7365.998 | | | |

a. Variable(s) entered on step 1: X4. X9. X11. X12. X15.

hypothesis stating that “there is not a great difference between the multiple discriminator method and the multiple regression method while determining the financial success/failures in the previous study (İşseverğlu, Gücenme 2008).

The X4, X9, X11, X12, X15 ratios best corresponding to the model were obtained as the result of analyzing 17 independent variables by stepwise method (Tables 8 and 9). The multiple correlation coefficient, R, between dependent and independent variables and integrated into the regression equality was 0.899. Adjusted $R^2$ (Adjusted R square), which is used to display the adaptability of the model to the universe, was high at 78%.

The exact prediction power of five financial ratios obtained through the multiple regression model were 93, 89 and 87% for the first, second and the third years, respectively. The same method was carried out in the multiple discriminator method which was compared with the multiple regression method. The stepwise method was used. The same financial ratios in the regression model were also obtained in the discriminator model. The financial ratios being the same in both models demonstrate important differentiation power in classifying enterprises.

The significance value was less than 0.05, showing that the model is important with a 95% reliability level (Tables 10 and 11). The model has substantial differentiation power with a Wilk’s Lambda value of 0.191. Wilk’s Lambda value (1-Wilk’s Lambda) signifies that 81% of the information is captured by the model by using the 17 independent variables. The multiple discriminator models’ power to predict enterprises’ financial success / failure in the previous 1, 2 and 3 years is 100, 94 and 81%, respectively.

## Conclusion

The early warning system is an important study laying the foundation for a more competitive technical and financial structure and operationalizing the sector’s auto-control mechanism. The early warning system should be used to identify insurance companies that are failing and not satisfying their obligations in order to set up an insurance consciousness and to achieve a higher standard of success by raising the performance of the sector to global norms.

The exact prediction power of the five financial ratios

**Table 8.** Model obtained by the multiple regression analysis.

| | | Not standardized coefficients | | Standardized coefficients | | | Co linearity statistics | |
|---|---|---|---|---|---|---|---|---|
| **5** | **(Constant)** | **B** | **Standard error** | **Beta** | **T** | **Sig.** | **Tolerance** | **VIF** |
| | | **0.308** | **0.050** | | **6.199** | **0.000** | | |
| | X15 | 2.237 | 0.264 | 0.636 | 8.460 | 0.000 | 0.867 | 1.154 |
| | X4 | 0.252 | 0.046 | 0.405 | 5.456 | 0.000 | 0.890 | 1.124 |
| | X9 | 0.689 | 0.165 | 0.551 | 4.178 | 0.000 | 0.282 | 3.543 |
| | X11 | -1.770 | 0.517 | -.420 | -3.424 | 0.000 | 0.326 | 3.066 |
| | X12 | -3.446E-02 | 0.014 | -.227 | -2.409 | 0.000 | 0.555 | 1.803 |

**Table 9.** Model coefficient obtained by the multiple regression analysis.

| Model | R | $R^2$ | Adjusted $R^2$ | Standard error of the estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | 0.899 | 0.809 | 0.784 | 0.2129 | 1.583 |

a. Predictors: (Constant). X15. X4. X9. X11. X12.
b. Dependent Variable: SUCCESS.

**Table 10.** Wilk's Lambda statistics.

| **Wilk's Lambda** | | | | |
|---|---|---|---|---|
| **Test of functions** | **Wilk's Lambda** | **Chi –square** | **Df** | **Sig.** |
| 1 | .191 | 67.003 | 5 | .000 |

**Table 11.** Multiple discriminator analysis model.

| Canonical discriminator function coefficients | Function |
|---|---|
| | 1 |
| X4 | 1.382 |
| X9 | 3.780 |
| X11 | -9.707 |
| X12 | -.189 |
| X15 | 12.267 |
| (Constant) | -2.213 |

obtained through the logit model were 100, 93.3 and 82.2% for the first, second and the third years, respectively. In the regression model, the results were as follows; 93, 89 and 87% for the first, second and the third years respectively. The fact that the financial ratios are the same in three models shows that they are important differentiators in classifying enterprises. The multiple discriminator model's' power to predict enterprises' financial success / failure exactly in the previous first, second and the third year was 100, 94 and 81%, respectively.

The validity of the model that we have developed could be tested during the study by integrating data from 2005 and 2006. Five companies emerged with early warning signals in three models based on data of the period 2003 – 2006. Some companies were under severe risk in the 2006 - 2004 classification, despite being among the successful companies in the 1992 - 2002 classification. Firms 8, 14, 16, 22 and 30 left the sector based on the activity reports of the Insurance Supervisory Board.

The (+) symbol displayed on Table 12 indicates that companies were accepted as failed in the study were correctly predicted by the models developed in the analyses during the first, second and third years preceding the failure. The (-) symbol indicates that the prediction failed, while the (*) symbol indicates that the relevant company was at the bottom-most limit for successful companies ratings.

Models obtained in the study were applied to the enterprises' data from 2006, 2005 and 2004. Risk ratings of enterprises accepted as successful, based on data from the period 2004 – 2006 was shown on Table 8, Firms 8, 14, 16, 22 and 30 were under severe risk based on the 2006 - 2004 classification, despite being among the successful companies in the 1992 - 2002 classification. Since these firms have been deemed non-successful based on activity reports from the Insurance Supervisory Board, Firm 8, 14, 16, 22 and 30 have left

**Table 12.** Early warning power of models for the year 2007.

| Firms | Multiple regression analysis | | | Multiple discriminant analysis | | | Logit analysis | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2006 | 2005 | 2004 | 2006 | 2005 | 2004 | 2006 | 2005 | 2004 |
| 25 | _ | _ | * | _ | * | _ | * | * | _ |
| 32 | * | _ | * | * | * | * | * | * | * |
| 8 | + | * | + | + | + | + | + | + | + |
| 14 | _ | _ | _ | + | + | + | + | + | + |
| 3 | + | _ | _ | + | _ | - | * | * | * |
| 4 | + | _ | * | * | _ | * | * | * | * |
| 15 | * | * | _ | * | _ | _ | * | * | * |
| 16 | + | * | * | + | * | * | + | + | + |
| 22 | _ | + | _ | + | + | * | + | * | * |
| 33 | _ | * | _ | _ | _ | * | * | * | * |
| 17 | * | * | _ | * | * | _ | * | * | * |
| 30 | * | * | + | + | + | * | + | * | * |
| 6 | _ | * | * | _ | _ | + | * | * | * |
| 5 | _ | _ | * | _ | + | + | * | * | * |
| 15 | * | * | * | * | _ | * | * | * | * |
| 27 | _ | * | * | _ | _ | _ | * | * | * |

the sector. It was noteworthy to observe that these companies emitted early warning signals according to logit, regression and discriminator models. Firm 8, 16 and 30 for example, emitted early warning signals for three consecutive years in the three models. Firm 14 and 22 emitted this signal for three consecutive years in two models. The other companies were classified as under severe risk despite being classified among the successful companies in the 2002 classification.

The empirical results of the logit study further indicate that the model provide impressive prediction accuracy and outperforms other popular models based on financial ratios. The study revealed that the results obtained through developed logit model are also powerful enough to describe the current situation as well.

## REFERENCES


Altman IE (1993). Corporate Financial Distress and Bankruptcy. A Complete Guide to Predicting and Avoiding Distress and Profiting From Bankruptcy II Ed., New York.

Altman IE (1968). Financial Relations, Discriminant Analysis and the Predictions of Corporate Bankruptcy, J. Fin. V: 23(4): 589-590.

Bartol MK, Martin CD (1991). Management, McGraw-Hill Inc., New York pp. 223-224.

Beaver HW (1966). Financial Ratios as Predictors of Failure Supplement to J. Account. Res. 71-111.

Beaver WH (1968). Market prices, financial rations, and the prediction of failure. J. Account. Res. pp. 179-192.

Blum M (1974). Failing Company Discriminant Analysis, J. Account. Res. 12(1): 1-25.

Dambolena IG, Khoury S (1980). Ratio Stability and Corporate Failure, J. Fin. 35(4): 1017-1026.

Deaken EB (1972). A Discriminant Analysis of Predictors of Business Failure, J. Account. Res. 10(1): 167-169.

Edmister OR (1972). An Empirical Test of Financial Ratio, Analysis for Small Business Failure Prediction, J. Fin. Quant. Anal. pp. 1477-1493.

Eisenbeis RA (1977). Pitfalls in the Application of Discriminant Analysis in Business, Finance, and Economics. J. Fin. 32: 875-900.

İşseveroğlu G (2005). Türk Sigorta Şirketlerinde Finansal Başarının Ölçülmesi ve Bir Uygulama, [Prediction Of The Financial Success In Insurance Companies and A Application]., Unpublished Ph.D. Dissertation, Uludağ Üniversitesi Sosyal Bilimler Enstitüsü İşletme Ana Bilim Dalı, Bursa.

İşseveroğlu G, Gücenme Ü (2008). Prediction Of The Financial Success In Insurance Companies, Ankara Üniversitesi Siyasal Bilgiler Fakültesi Dergisi, Cilt: 62, Ekim-Aralık 2007 4: 125-140.

Libby R (1975). Accounting Ratios and the Prediction of Failure, Some Behavioral Evidence, J. Account. Res. pp. 150 -161.

McGurr PT, DeVaney SA (1998). Predicting Business Failure of Retail Firms: An Analysis Using Mixed Industry Models, J. Bus. Res. 43: 169-176.

Meyer AP, Pifer WH (1970). Prediction of Bank Failures, J. Fin. 25(4): 835-868.

Ohlson JA (1980). Financial Rations and the probabilistic Prediction of Bankruptcy, J. Account. Res. 18: 109-131.

Platt HD, Platt M (1990). Development of A Class of Stable Predictive Variables: the Case of Bankruptcy Prediction, J. Bus. Fin. Account. 17: 31-51.

Sullivan A, Warren E, Westbrook J (1998). Financial Difficulties of Small Businesses and Reasons for Their Failure, Unpublished for Small Business Administration.

Zavgren CV (1985). Assessing the Vulnerability of Failure of American Industrial Firms: A Logistic Analysis, J. Bus. Fin. Account. 12:19-45.