



Comparison of the Effectiveness of Machine Learning Models and Statistical Models in Predicting Financial Risk¹

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INTRODUCTION

One of the primary concerns of market experts is the information that companies provide. Predicting the reliability of a company's condition gives investors an opportunity to make a more informed investment decision. The basis of investment decisions in an efficient market is the relationship between risk and return. In an efficient market, getting higher returns is only possible by accepting higher risk. Providing forecasting models about the company's overall outlook and financial risk is one way to assist stakeholders of a company. By predicting the financial risk of companies, it is possible to do the necessary planning to prevent their inevitable failure. Financial risk forecasting models are one of the tools used to estimate the future state of companies. To survive and thrive in a highly competitive market, business entities must control possible financial risks and predict their future financial development by utilizing forecasting models.

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PURPOSE

Given the importance of financial risk and the reassurance of shareholders, the primary objective of this research is to compare the accuracy of financial risk predictions for listed companies in the Tehran Stock Exchange, using both statistical models and machine learning models.

RESEARCH HYPOTHESES

The accuracy of financial risk prediction of machine learning models is significantly higher than statistical models.

RESEARCH METHODOLOGY

This research is descriptive in nature and aims to compare the accuracy of financial risk prediction between machine learning models (32 models) and statistical models (14 models). The data used in this research consists of real information and financial statements of companies listed on the Tehran Stock Exchange. The data analysis was conducted using software such as Rapid Miner, SPSS Modeler, Weka, SPM, E-Views, SPSS Statistics, and Minitab. The population of this research includes companies listed on the Tehran Stock Exchange from 2010 to 2020. The sampling method used in this research was targeted sampling.

RESULTS TEST of RESEARCH HYPOTHESES

To comprehensively evaluate the capabilities of the models, the criterion of prediction accuracy, the value of the area under the curve and the characteristic criterion of system performance, and to check the hypothesis of the research, the comparison test of the coefficients of prediction accuracy has been used.

DISCUSSION and CONCLUSION

This research seeks to answer the question of whether the accuracy of financial risk prediction of machine learning models is significantly higher than that of statistical models. Based on the results of the comparison test of the prediction accuracy coefficients of machine learning models and statistical models, it was determined that since the value of the Z statistic is equal to 55.68 and significant at the 1% error level,



there is a 99% confidence that the prediction accuracy of machine learning models is higher than that of statistical models.

Table 1. Comparing the efficiency of machine learning models and statistical models

Model	N	Mean	Std. Deviation	P-Value	Z-Value
Machine learning	32	.866590625000000	.102877566943634	0.000	55.68
Statistical models	14	.838678571428571	.163752107108329		

Additionally, it was found that the best machine learning model after optimization was the evolutionary support vector machine model, which achieved a prediction accuracy of 99.86 percent. Moreover, it was observed that accrual financial ratios, with a prediction accuracy of 99.45 percent, and activity financial ratios, with a prediction accuracy of 98.62 percent, performed better compared to other financial ratios when using the evolutionary support vector machine to predict financial risk. It was also determined that machine learning models can be used as an important tool in predicting the financial risk of companies due to their lack of limitations faced by statistical models, such as not considering the distribution of communities, not having problems with collinearity between explanatory variables, and having adaptive learning capabilities.

SUGGESTIONS

According to the findings of the research, potential and actual investors are advised to use the evolutionary support vector machine model introduced in this study and the selected variables to predict the financial risk of companies in investment decisions. Financial ratios are also identified as an important tool for predicting financial risk, which can help prevent losses to the country's economy and the company's stakeholders and enable effective sector management to control the occurrence of impulse or fluctuations.

In terms of future research, esteemed researchers are recommended to compare listed and non-listed companies in different industries and investigate the impact of macroeconomic variables such as GDP growth, liquidity growth, bank interest rate fluctuations, and currency fluctuations on the financial risk of companies. Additionally,

combining classification techniques like support vector machine with clustering techniques can provide researchers with a different perspective on predicting financial risk.

Keywords: Financial Risk; Machine Learning; Prediction; Support Vector Machine Evolutionary.

JEL Classification: C53, G32.

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