TIME POSTPONENTS OF CLASSICAL CORPORATE BANKRUPTCY MODELS

Dagmar Čámská

Abstract

This paper focuses on an issue of prediction corporate bankruptcy or default. There exist several approaches how to predict or forecast this unfavourable enterprise situation. One approach can be presented by bankruptcy models (also known as models predicting financial distress) which were created on the basis of financial accounting data by a technique as discriminant analysis. The basic aim of this contribution is not to solve a general models' accuracy. This paper focuses on time postponements or delays of the prediction. On one hand the accurate models are able to predict the future enterprise situation from the point of view of financial distress on the other hand their strengths is connected with the issue how in time they are able. This contribution will provide verification for three different time moments – two years, three and four years prior to bankruptcy. The data set consists of enterprises belonging to CZ-NACE F Construction which went bankrupt according to the Czech insolvency law. The results will show strengths of classical corporate bankruptcy models often used in the Czech Republic as Altman Z-Score, family of IN indices and several others.

Key words: Altman, Family of IN indices, Czech Republic, CZ-NACE F Construction

JEL Code: G33, M21

Introduction

Financial viability is one of requirements for fulfilling the corporate going concern principle. Financial management itself cannot manage long term enterprise functioning because it is especially ensured by the market success of an enterprise product. However, financial conditions and situation can detect enterprise problems which can even result in a bankruptcy and market exit. Components of financial standing are summarized by Kapliński (2008) as the company's financial structure, financial liquidity, solvency, the company's capability to adapt, economic sources, capability to generate profit, capability to maximise the company's market value. Enterprise managers need to know the financial situation but they have many available pieces of information based on financial statements, managerial accounting, reports from the market, feedback from customers etc. On the other hand there are many other partners whose access to information is limited and they have to depend especially on the annually published financial statements. These partners can be suppliers, customers, banks or another financial institutions, government etc. Partnership with financial healthy enterprises is crucial for their long-term existence. As a consequence, researchers as well as practitioners construct methods and tools which are able to assess corporate financial conditions or predict future financial situation.

Importance of this research topic also results from the number of the default enterprises. This number dramatically increased since 2008 because of global economic crisis and new insolvency act in the Czech Republic. Details could be found in Svobodová (2013) or Smrčka and Malý (2013). Decreases of the number of the insolvent enterprises were observed in years 2014 and 2015. As a consequence, this environment supports efforts for the methods predicting financial distress. Very popular group of these tools is called models predicting financial distress. Prediction of financial distress has been a serious research issue since 1960's. Beaver (1966) is considered as the first real research paper in this area. On the contrary, the most known paper is Altman (1968) where first model predicting financial distress was introduced.

There is a plenty of the models which should provide prediction about the future financial situation. They especially focus on possible corporate default. The papers can deal with a construction of new models, verifying accuracy of already existing tools or comparison of results provided by different models. The aim of this paper is not so general. On one hand the paper will compare the results provided by the classical models predicting financial distress. On the other hand the main goal is more ambitious because the general models' accuracy should not be discussed as the primary aim. The paper should focus on time postponements or delays of the prediction. Users need the prediction of possible future financial default in advance. The sooner the model can detect future bankruptcy the better.

1 Corporate bankruptcy models

Classical bankruptcy models predict future corporate financial situation. As mentioned above the models predicting financial distress have been created since 1960's. Their construction is based on linear discriminant analysis. The used data are taken from the financial statements. The financial statements have to cover the time period prior to the bankruptcy. Generally the models are constructed on the data covering one specified time moment. It is one or two years prior to the bankruptcy. Some models' verification is not based only on the out-data sample but also on the different time moments. Beaver (1966) analysed the time period covering 5 years before the bankruptcy. Logically, older accounting records provide the same or worse results than newer documents. This statement is confirmed by Beaver (1966) who verified that newer records are able to predict the future corporate financial situation better. Altman (1968) verified his model also in different time frames. He tested first, second, third, fourth and fifth year prior to the bankruptcy. Karas and Režňáková (2014) also use five different time moments for the verification. Korol and Korodi (2010) tested three years prior to the bankruptcy and their model also contains dynamic indicators as macroeconomic variables. The verification of the models' accuracy depends heavily on the time. If the model is tested closer to the construction time it will provide higher accuracy and power. If the model is tested on the financial data closer to the bankruptcy there will be a higher chance that the model will be able to detect the future corporate ailing. It is the main reason why the verification is usually based on the data one or two years prior the bankruptcy and older records are not used.

2 Research

This chapter is dedicated to the own research. The following parts consist of definition of the research question, introduction of data sample used for an analysis and mentioning of verified models and explanation of used analytical method.

2.1 Research question

The research question is derived from an idea of the time postponements and delays of the prediction. The importance of early forecast has been already discussed. Czech enterprises very often enter the insolvency proceeding too late because they do not own almost any property at that time (Čámská, 2013). It should be noted that this situation is generally called as property enterprise emptiness. It is worth pointing out that signs of future financial collapse should have been visible in the financial statements earlier. This paper will provide testing for three different time moments – two years, three and four years prior to the bankruptcy. This analysis will be based on the selected models mentioned in the following part. This research question verifies the idea if there exist the models predicting financial distress which are able to provide the right forecast for the longer analysed time period. The basic time moment for the bankruptcy detection is usually two years prior to the bankruptcy (used by Altman (1968, Karas and Režňáková, 2014 or Čámská, 2016). The paper searches an answer if the models provide the same prediction also three or four years prior to the bankruptcy.

2.2 Used models and methods

There is a plenty of the models which should provide prediction about the future financial situation. This paper focuses on the classical bankruptcy models constructed on the bases of discriminant analysis. The paper range does not allow the full models' formulas and therefore only a list of used models is mentioned further. References for mentioned models are available in Čámská (2016). This paper analyses same models predicting financial distress as the paper Čámská (2016) published in the journal with impact factor. Three dozen following models are being tested. The group of the Czech models consists of IN99, IN01, IN05, Grünwald Bonita Index and Balance Analysis System by Doucha. The developed economies are represented by traditional approaches as Altman Z-Score, Bonita Index or Kralicek approach. These models are followed by the models created in Poland, Hungary and Baltic states which have comparably history and economic development with the Czech Republic. The group of Polish models contains Hadasik, Holda, Gajdka & Stoda, Prusak, PAN-E, PAN-F, PAN-G, Wierzba, Poznanski, Apenzeller & Szarec and finally Pogodzinska & Sojak. Hajdu & Virag model presents Hungary. Baltic states are represented by Šorins & Voronova, Merkevicius, two factor model and last R model.

The results provided by all models will be computed in three different time moment (two, three and four years prior to the bankruptcy). It is computed for each enterprise from the used data sample which is described in the following part. The model can classify the enterprise as healthy, unhealthy or belonging to the grey zone. All tested enterprises are unhealthy because they went bankrupt. The error of the model occurs when the enterprise is classified healthy. The final score is computed as an average. The final score is the average amount of errors occurred in the three analysed years. The errors are computed for each enterprise and the final score is sum of the errors for all enterprises divided by the number of analysed enterprises. The possible maximum is 3. It must be emphasized that result 3 means that the model classifies the enterprise as healthy in each period. In the case of average that all enterprises are classified fully wrong. It is the worst possible result which can be reached. The best reached result is 0 because none error occurred. This method is an example of descriptive statistic which will be used in absolute as relative terms. The absolute approach is introduced above. The final score can vary between 0 and 3. This score can be transformed into relative terms in percentage. The final score is divided by 3 (3 = 100%). Although it has the same explanatory power it is more user friendly approach. The relative approach could be described as normalization of the dependent variable.

2.3 Data sample

Data sample contains 65 enterprises which have many common characteristics. All enterprises are legal entities and they belong to the same industry branch. Specifically, it is construction industry classified as CZ-NACE group F. The enterprises went bankrupt and they have the comparable time moment of bankruptcy declaration. Their insolvency proceedings were declared in 2012, 2013 or first quarter 2014. It must be emphasized the data sample does not consists of all enterprises which went bankrupt during the mentioned time period. The main obstacle is non-availability of financial statements. The financial records have been obtained from the corporate database Albertina. Some enterprises did not publish the records at all and some did not have the compact time period and therefore they had to be omitted. After this selection we came to the number 65 enterprises.

3 Results

Gained results are displayed in table 1 which consists of 3 columns. The first column introduces the analysed model. On contrary, other two columns show the gained results and accuracy of the tested model. The second column contains the results displayed in absolute terms and the third one shows results in relative terms. The ways of computation are described in the previous part. As it can be seen an order of the models in the table is not random. The models are ranked from best to worst. The results below (second column) 0.5 are extremely good. The interpretation is that the model provides the error only in 0.5 period of 3 analysed periods for all selected enterprises. It must be emphasized that all models predicting financial distress work on probabilistic roots and there will always occur some errors. None model is able to work without any error and therefore the models with less errors work better than the others. On the contrary, the models which absolute terms exceed 2 are extremely weak and they do not provide good results for decision making. It should be pointed out that these models had errors in more than 2 periods of 3 in average for all enterprises. Their explanatory power is not sufficient.

Tab. 1: Analysed models and their number of errors

Model	ABSOLUTE TERMS Average amount of errors occurred in 3 years per one enterprise	RELATIVE TERMS Average amount of errors occurred in 3 years per one enterprise
Pogodzinska & Sojak	0.04	1.33%
Prusak2	0.094	3.14%
Prusak1	0.2	6.67%
IN99	0.207	6.92%
Merkevicius	0.25	8.33%
IN01	0.25	8.33%
IN05	0.25	8.33%
Altman	0.41	13.69%
Šorins & Voronova	0.446	14.88%
PAN-G	0.716	23.90%
Bonita	0.718	23.96%
PAN-F	0.905	30.19%
Rmodel	0.937	31.25%
Grünwald	1	33.33%
Hadasik	1.115	37.18%
Poznanski	1.24	41.33%
Doucha	1.272	42.42%
PAN-E	1.272	42.42%
Kralicek	1.347	44.93%
Holda2	1.413	47.10%
Gajdka & Stoda 2	1.625	54.17%
Apenzeller & Szarec	1.8	60.00%
Wierzba 2	2.16	72.00%
Wierzba 1	2.2	73.33%
Gajdka & Stoda 1	2.28	76.00%
Hajdu & Virag	2.396	79.87%
2factor model	2.714	90.48%
Holda1	2.911	97.04%

Source: own results

The lowest number of the errors is connected with Pogodzinska & Sojak, both Prusak models, indices from family IN (IN99, IN01 and IN05), Merkevicius, Altman, Šorins & Voronova. In relative terms it could be said that their explanatory power reaches 85% and more. This is visible from the third column which displays the errors in relative terms. It means that the value 1 – the number in the third column displays the number of good predictions.

The general breaking point in the case of the predictions is the value 50%. Half of the results is correct and half in incorrect. If the error rate exceeds 50% the same results would be gained by a coin flipping. It has to be admitted that the coin flipping is not a smart research method. The worst results (the error rate exceeds 50%) are connected with the following models – Gajdka & Stoda 1 and 2, Apenzeller & Szarec, Wierzba 1 and 2, Hajdu & Virag, 2factor model as well as Holda 1.

Some models have not been mentioned yet. These models have explanatory power higher than 50% (visible as 1 – the number in the third column) but their errors were observed for more than 0.5 period. Their explanatory power is not weak but there were tested the models with higher accuracy. These results are reached by the models of PAN family (PAN-G, PAN-F and PAN-E), Bonita index, R model, Grünwald model, Hadasik, Poznanski, Balance Analysis System by Doucha, Kralicek approach and Holda 2.

Conclusion

The paper dealt with the prediction of the future financial distress. This distress was observed as the corporate default (in other words bankruptcy or insolvency) at the end. The explanatory power of three dozen models predicting financial distress was tested. The results extremely depended on the used model. It must be emphasized that all models predicting financial distress work on probabilistic roots and there will always occur some errors. On the other hand, the error rate of some selected models was too high. These models are not suitable for further decision making. Other models whose error rate was low are suitable for further testing. This paper focused only the ailing enterprises because the sample did not contain healthy statistical units. Some models could be omitted later because they are too strict. They will even punish the healthy enterprises with the label facing bankruptcy.

Another issue is that the model does not have to always provide the prediction. There are not enough data for the prediction. First the financial records are not available. It means that none model using financial data will be able to provide the prediction. On the contrary, this situation can also occur for some models when the financial statements are fully available. Their computation is based on items whose value is equal to zero. When these items occur in denominator the model cannot process the result for its user. This reason explains a partial discrepancy observed in table 1. All enterprises could not be verified by each selected model because of missing or equal zero data. It concludes in the second way of further testing. The robustness of the model should be also quantified and emphasized when the model is selected. Not only high explanatory power but also robustness can ensure the accurate results for the user.

References

Altman, E. I. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *Journal of Finance*, *23*(4), 189-209.

Beawer, W. (1966). Financial Ratios as Predictors of Failure. *Journal of Accounting Research*, *4*(3), 71-111.

Čámská, D. (2016). Accuracy of Models Predicting Corporate Bankruptcy in a Selected Industry Branch. *Ekonomický časopis, 64*(4), 353-366.

Čámská, D. (2013). Basic Characteristics of Enterprises in Insolvency. In *International Scientific Conference on Hradec Economic Days 2013 - Economic Development and Management Region* (pp. 83-88). Hradec Králové: Gaudeamus.

Kapliński, O. (2008). Usefulness and Credibility of Scoring Methods in Construction Industry. *Journal of Civil Engineering and Management*, *14*(1), 21-28.

Karas, M., & Režňáková, M. (2014). Possibilities for Application of a Bankruptcy Prediction Model for Measuring Credit Risk of a Company. In *12th International Conference on Hradec Economic Days (HED 2014): Economic Development and Management of Regions* (pp. 435-442). Hradec Králové: Gaudeamus.

Korol, T., & Korodi, A. (2010). Predicting Bankruptcy with the Use of Macroeconomic Variables. *Economic computation and economic cybernetics studies and research, 44*(1), 201-219.

Smrčka, L., & Malý, T. (2013). Some Suggestions for Interpreting Statistical Data on Insolvency in the Czech Republic. In *Proceedings of the 6th International Scientific Conference: Finance and the performance of Firms in Science, Education and Practice* (pp. 695-706). Zlín: Univerzita Tomáše Bati.

Svobodová, L. (2013). Trends in the number of Bankruptcies in the Czech Republic. In *International Scientific Conference on Hradec Economic Days 2013 - Economic Development and Management Region* (pp. 393-399). Hradec Králové: Gaudeamus.

Contact

Dagmar Čámská
Czech Technical University in Prague, MIAS School of Business & Interdisciplinary Studies,
Department of Economic Studies
Kolejní 2637/2a, Prague 6, 160 00, Czech Republic
dagmar.camska@cvut.cz