

**University of Sopron
István Széchenyi Economic and Management
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**VERIFYING THE RELIABILITY OF CRISIS
PREDICTION MODELS IN THE DOMESTIC SME
SECTOR, WITH A SPECIAL FOCUS ON THE
HOSPITALITY, HOTEL AND RETAIL SECTORS, FOR
SELECTED STATISTICAL REGIONS**

Theses of Doctoral (Ph.D.) dissertation

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1. Content of the research

1.1. Actuality of the topic

In recent years, the Covid19 epidemic and the subsequent restrictions, as well as the economic and inflation crisis of 2022, have again drawn attention to the importance and relevance of bankruptcy prediction models. The emerging crises have the greatest impact on the small and medium-sized enterprise (SME) sector, which is particularly vulnerable to external changes due to its size. Despite their vulnerability, the SME sector is a key factor from an economic point of view both in Hungary and the European Union (EU), as it plays a significant role in creating new jobs, promoting new ideas and development, and stimulating economic growth. Béza and his co-authors (2013) have also written that the SME sector is becoming increasingly important in the economy, as in most EU countries the economic weight of SMEs exceeds that of large companies due to their large number of elements. Investigations into the bankruptcy of the SME sector are very important, as in many cases these enterprises occupy an important position in the production chain and jobs are also lost with the closure of enterprises, which may reduce employment.

This suggests that investigations in the SME sector have a very important role. Controlling and continuous internal and financial analysis are essential for businesses to detect problems in time. According to Vecsenyi (2017), one of the most important steps is to detect signs of a crisis as early as possible and implement the necessary changes. This is why I consider it essential to use crisis forecasting models for businesses. For the SME sector, typically due to their size, little information is available, which makes it difficult to test these models. Therefore, my research aims to test the reliability of crisis prediction models in the SME sector.

1.2. Research objectives

The aim of my research is to investigate crisis prediction models as widely as possible, as I examine bankruptcy prediction in different economic sectors and regions. Accordingly, I set the following objectives for my research:

H1: Based on the database developed for this research, looking at the sample of the domestic SME sector (2012-2022), there are differences in the reliability and resulting usability of financial crisis prediction models.

H2: The reliability of financial crisis prediction models shows sectoral differences in the domestic SME sector. The reliability of financial crisis prediction models varies across the sectors of the economy included in the research (food retail, hotels and restaurants).

H3: The reliability of financial crisis forecasting models in the examined domestic SME sector is affected by the length of the forecasting time horizon.

H4: For the different types of termination procedure (compulsory and voluntary), there are detectable differences in the reliability of the models in the investigated domestic SME sector.

H5: Geographical location in all three sectors influences the reliability and consequent usability of bankruptcy prediction models in the domestic SME sector over the examined period.

2. Research method

The results of my dissertation are based on database analysis, during which I examined the applicability of bankruptcy forecasting models using data, based on the Hungarian SME sector. The database analysis is basically based on the balance sheet and profit and loss account data of the selected companies, supplemented with dividend payment data. The research have also included regional comparisons, classification by economic activity and time series analysis using different time series. In order to make regional comparisons, the database was designed in two statistical regions, taking into account the geographical location: the western statistical region consists of the counties of Győr-Moson-Sopron, Vas and Zala, and the eastern statistical region consists of the counties of Borsod-Abaúj-Zemplén, Hajdú-Bihar and Szabolcs-Szatmár-Bereg. The research regions were also designed with development in mind. Komarek (2019) also found that differences in development were persistent at the regional level, such as the difference between the western and eastern parts of the country, so I also took into account per capita GDP values in the design of the regions.

To test the models, I classified the companies into three economic sectors that were most affected by the economic events of recent years: food retail, hotel industry, catering. The full database contains 9 063 businesses, of which 2 940 have closed down. The methodology of my research is basically have two parts:

1. Testing of bankruptcy models: Testing the reliability of the selected bankruptcy models on a sample of the domestic SME sector. The calculations were performed in Excel and the main calculation results are presented in the dissertation to establish and support the conclusions.

2. Crosstabulation analysis: Crosstabulation analysis was used to show the relationship/correlation between variables. The relationship was tested using Statistical Package for Social Sciences 22 (SPSS 22) statistical software.

3. Results

3.1. Results of hypothesis testing

Based on the examined database, the following results were determined:

T1: In the examined domestic SME sector, bankruptcy forecasting models cannot be applied uniformly and their forecasting accuracy is different.

In the SME sector, due to the relatively limited data available, some bankruptcy models can be used less effectively to anticipate crisis times. In the examined statistical regions there are major differences in the predictive reliability of the investigated 9 bankruptcy models. In order to make accurate predictions, it is advisable to use several models at the same time and thus weigh the obtained results.

T2: The reliability of bankruptcy forecasts varies across different economic sectors.

The test results show that there are differences in the reliability of bankruptcy prediction models depending on the sector for which they are used.

The reliability of some models is much higher in certain sectors. This suggests that sector-specific characteristics can be observed in the usability of bankruptcy prediction models.

T3: There are no major differences in the accuracy and reliability of bankruptcy models over time.

Based on the results obtained, there is no clear evidence of a decrease in the reliability of bankruptcy models in the examined sectors of the domestic SME's as the time horizon increases. For the most reliable models, the forecast accuracy decreases in the medium term. For longer-term studies, the number of elements is smaller, which may distort the results. Considering nine bankruptcy models together, the short-term test results are the most accurate.

T4: Termination procedure types affect the predictive reliability of financial crisis forecasting models.

Due to the nature of the types of termination proceedings and the underlying causes, there are also differences in the bankruptcy prediction models. These differences can be detected not only in the reliability but also in the time horizon.

Forced procedure types typically have higher reliability for bankruptcy models.

T5: Differences in the geographic location of firms in the examined SME sector affect the reliability of financial crisis forecasts.

The literature review has shown that small and medium sized enterprises are very sensitive to external changes, crises and changes in their environment. Geographical differences and the resulting territorial development have an impact on the closure of small and medium-sized enterprises and on the applicability of bankruptcy models, as some models can be applied more accurately in different regions. Geographical location determines the existence of certain financial type phenomena, which affect the forecasting reliability of models through changes in the value of indicators included in financial crisis forecasting models.

3.2. New and novel results

The research focuses on the domestic small and medium-sized enterprise sector and the applicability of crisis prediction models. Based on the obtained results, the following new and novel findings can be identified:

1. Based on the sample, the examined bankruptcy models cannot be applied uniformly to the domestic SME sector. In total, the analysis of 9 bankruptcy models showed that basically 4 models have a higher prediction reliability.
2. The reliability of the models varies depending on the sector of the economy in which they are tested. In the case of bankruptcy models, the effects of sector-specific characteristics are shown.
3. In the case of a time horizon analysis, the short-term forecast is the most accurate. Increasing the time horizon partly affects the accuracy of the bankruptcy prediction models. For the four models with the highest reliability, the reliability decreases as the time horizon increases.

4. The reliability of bankruptcy models is affected by the type of business closure and a correlation can be shown between the two types. Different types of business closures affect the reliability of bankruptcy prediction models. The accuracy of the models is higher for forced liquidation.

5. Differences in the geographical location of firms affect the reliability of financial crisis forecasts and the likelihood of firms closing down.

4. Summary

The research investigated the reliability of bankruptcy prediction models for the SME sector, which plays a very important role in Hungary, as more than 99% of enterprises belong to this category and they also play an important role in creating new jobs. Nevertheless, the sector is very vulnerable to external changes. While the Covid19 crisis had a major impact on certain sectors, the 2022 crisis has affected the whole sector and has led to an increase in the number of closures. Analysis has a key role to play within the company, as the information revealed by the analysis can be used to identify emerging problems.

Managing the crisis is a complex process that requires a wide range of knowledge. Quick and professional identification and appropriate action is the key to successful crisis management. The literature review does not only cover the general characteristics of the SME sector and bankruptcy models, but also provides detailed insights, including:

- a presentation and comparison of the EU and Hungarian SME sector,
- the main features of analysis and controlling and the importance of this area,
- the characteristics of dissolution and bankruptcy, including the appropriate management of crises,
- and the main domestic and international bankruptcy models.

The processing and systematization of a large amount of Hungarian and international literature along this approach can definitely be considered one of the strengths of the dissertation.

The aim of this dissertation is to test the reliability of bankruptcy prediction models in the SME sector, and thus I have defined my hypotheses in this research area. In total, I created 5 hypotheses that tested the models on the basis of regional, sectoral and time span.

The dissertation examines the applicability of bankruptcy models to the SME sector in a broad context. The analysis is based on the following criteria:

- analyses developed with a large number of data in a database covering the entire population in a given region,
- examination of national and international bankruptcy prediction models,
- geographical location and the resulting regional variations,
- studies with different time horizons,
- studies by different sectors of the economy.

The database analysis and SPSS calculations fully confirmed 4 hypotheses and partially confirmed one. These allowed me to draw the main findings of my research.

Main conclusions and results of the research:

- Bankruptcy prediction models cannot be applied uniformly across the sectors of the studied SME's.
- The reliability of individual models can vary considerably depending on the sector of the economy in which they are used.
- By looking at bankruptcy prediction models over time, they can detect potential risks even over the longer term.
- Different types of procedures affect the reliability of bankruptcy prediction models, with forced procedure types typically having higher reliability.
- Differences in the geographical location of firms affect the reliability of financial crisis forecasts and the likelihood of business closures.

5. Possible directions of continuation of the research topic

Summarising the results of the research, it provides a lot of new and relevant information for enterprises in the SME sector and for further research, as I have analysed SMEs by regional and economic sector with a large sample of elements.

The results of my research will hopefully raise awareness on the use of bankruptcy prediction models, as early identification of the problem will allow for the design of appropriate responses and changes, which in many cases can help to avoid the closure of the business. In addition to the conclusions and recommendations of the research, I consider it essential to identify further possible improvements of the research topic. The limitations of my research are the area, sample and the covered sectors. Since I have delimited the research area along these lines, it is not suitable for drawing conclusions at national level. These limitations give me the scope to extend my research. In the future, the research could be extended in the following four directions: increasing regional coverage, expanding the examined sectors, expanding the number of bankruptcy models and making international comparisons.

6. Bibliography

Béza et al. (2013): *Kisvállalkozások finanszírozása*, Budapest, Perfekt Kiadó, 375 p. ISBN: 978-963-394-825-5

Komarek L. (2019): *Hasonlóságok és különbségek Magyarországon területi fejlettségében. Jelenkori társadalmi és gazdasági folyamatok*, 14 (3) 29–43. o.

Vecsenyi J. (2017): *Kisvállalkozások indítása és működtetése*. Akadémiai Kiadó, Budapest, ISBN: 978-963-454-225-4, Forrás:

https://mersz.hu/hivatkozas/dj296kiem_impreszum_p9/#dj296kiem_impreszum_p9, Letöltés ideje: 2023. 09. 21.

7. Relevant publications

Patyi Balázs – Szóka Károly – Pataki László (2023): *Applicability of bankruptcy prediction models in the western hungarian food retail sector*. *Acta Academiae Beregsasiensis. Economics*, 4 pp. 227-239., 13 p.

Patyi Balázs - Pataki László (2020): *The main financial characteristics of the successfully operating newly established enterprises*. *nSELYE E-STUDIES* 11 : 2 pp. 17-27., 11 p.

Patyi Balázs – Pataki László (2021): Examination of financial type phenomenas of domestic vehicle manufacturing companies. In: Pop Gh. et al. (szerk.) Challenges in the Carpathian Basin: global challenges - local answers: interdependencies or slobalisation?: 15th International Conference on Economics and Business, Cluj-Napoca, Románia : Risoprint (2021) 1,337 p. pp. 392-406., 15 p.

Patyi Balázs – Pataki László – Illés Bálint Csaba (2019): A pénzügyi diagnosztika jelentősége az újonnan alapított vállalkozások életében. LIMES: A II. RÁKÓCZI FERENC KÁRPÁTALJAI MAGYAR FŐISKOLA TUDOMÁNYOS ÉVKÖNYVE 6: 1 pp. 331-337., 7 p.

Patyi Balázs (2019): Establish an early warning system in newly established companies, or recognize the crisis by analyzing balance sheet and income statement datas. In: Illés, Bálint Csaba (szerk.) Proceedings of the International Conference on Management: “People, Planet and Profit: Sustainable business and society”: Volume I Gödöllő, Magyarország: Szent István Egyetemi Nonprofit Kiadó Kft, (2019) pp. 269-275., 7 p.