

## Abstract: Forecasting bankruptcy of enterprises in Poland in years 2019-2022

In the dissertation „Forecasting bankruptcy of enterprises in Poland in years 2019-2022”, the results of research on the use of linear discriminant models to forecast bankruptcy of Polish non-financial enterprises whose shares were not listed on the capital market are presented. This research defined the bankruptcy risk assessment problem as a dichotomous classification task. Companies that had filed for bankruptcy were taken into account, which allowed the identification of bankruptcy symptoms at a relatively early stage. Consideration was also given to the need to update bankruptcy forecasting methods in response to changing economic conditions by analysing two periods (the pre-Covid-19 pandemic period and the Covid-19 pandemic period), which allowed for a more accurate reflection of the contemporary realities of the Polish economy in which businesses operate. The use of industry specification and non-financial variables as potential determinants of enterprise bankruptcy risk, allowed the construction of models with higher classification efficiency. The conducted research filled the research space defined in the introduction to the paper, providing tools adapted to the specifics of the Polish economy and contemporary challenges related to the risk of enterprise bankruptcy.

The research objectives were realised in the study. The primary cognitive objective was to identify the key factors influencing the filing of bankruptcy petitions by Polish companies in 2019-2022. The application objective was also realised by building and testing predictive models allowing for an effective classification of companies at risk of bankruptcy. These models can become useful in identifying the problems of companies, thus providing tools to support early detection of risks and enable better management of bankruptcy risk. The individual chapters of the thesis have contributed to these objectives.

In chapter one, the evolution of the concepts of enterprise and entrepreneurship in economic thought. Changing approaches to the role of the entrepreneur, innovation and the coordination of resources in the enterprise are important for understanding how firms respond to market conditions and how the development of these concepts affects current management models. For management in a changing economic environment requires consideration of economic, social, legal and technological factors. An analysis of the structure of Polish companies between 2017 and 2022 was carried out. It was shown, that the non-financial sector was characterised by an increase in the number of micro-enterprises and a stable share of large companies, reflecting trends also observed in the European Union. Non-financial companies in Poland improved their profitability despite rising operating costs, although the situation of

Polish companies differed depending on the sector in which the entity was operating. The best performing sector in terms of profitability was the manufacturing sector, where the gross sales profitability ratio increased from 5.5% in 2017 to 7.3% in 2022. The retail sector also showed positive results, with gross sales profitability increasing from 2.9% in 2017 to 4.4% in 2022. The most difficult situation was in the services sector, where gross return on sales, at -4.93% in 2017, increased to -3.03% in 2022. The biggest problems became apparent in 2020, when this indicator reached its lowest value of -17.60%, demonstrating the strong negative impact of the Covid-19 pandemic on service activities in Poland.

Chapter two identifies corporate bankruptcy as a process resulting from the accumulation of financial problems and mismanagement of the crisis, which ultimately leads to bankruptcy. The definitional differences between bankruptcy and insolvency were highlighted. On the basis of macroeconomic data, the reliability of information on the number of bankruptcies of enterprises in Poland was questioned, showing that although the number of formal bankruptcies decreased, the total number of insolvencies increased, which was in line with the trend observed in European Union countries. This was an implication of the 2020 legal changes, which introduced simplified out-of-court proceedings, allowing companies to avoid court bankruptcy processes. The areas for assessing the financial standing of companies were characterised, as well as the prerequisites for bankruptcy identifiable through analysis of financial statements and ratios. On the basis of the literature analysis, a list of financial and non-financial factors was created, which are potential drivers of firm health and could be included as potential variables in bankruptcy prediction models in the empirical studies discussed in chapter five. These factors included traditional financial indicators, such as liquidity, profitability, operating efficiency or debt, and non-financial information, related to human resources, innovation, commitment to social responsibility or board structure.

Chapter three lists and describes the research methods used in the study. Chapter four characterises the process of building the database and the research sample, taking into account the following research assumptions:

- the data source was the EMIS database and the selection of companies was carried out in two stages: in the first stage, bankrupts were identified and in the second stage, non-bankrupts were matched (choice-based sample; matched sample),



- bankrupts were defined as companies that had filed a bankrupts were defined as companies that had filed for bankruptcy with the court, ensuring that the definition was unambiguous,
- non-bankrupts were defined as going concern companies, these entities were paired with bankrupts by industry and annual revenue size, which ensured comparability of the groups,
- the surveyed companies belonged to one of three industries: trade, manufacturing or services (each industry accounted for about 1/3 of all surveyed facilities), which made it possible to learn about the different sectors' potential rationale for bankruptcy,
- the database included observations on 416 companies,
- the time horizon of the study covered the years 2017-2022, allowing analysis of the determinants of bankruptcy under different macroeconomic conditions (including the Covid-19 pandemic period and the pre-pandemic period),
- financial statements from one and two years prior to the bankruptcy filing were included, allowing bankruptcy danger signals to be identified at a relatively early stage.

The analysis of the structure of the studied communities showed that bankrupts are characterised by negative values of means and medians of most characteristics, with high asymmetry due to the presence of outlier observations, highlighting their extremely unstable financial situation. In the case of non-bankrupts, the mean and median values of most characteristics were positive, and their variability much lower. The analysis of the dynamics showed that among bankrupts, a significant decrease in the mean values of most financial characteristics was observed one year before the bankruptcy filing (net result - decrease of 481.5%; gross result - decrease by 391.2%; operating result - decrease by 305.2%), confirming the deepening crisis in the companies. These observations are also reflected in the values of the modified distance index (WO'). Bankrupts were in a significantly worse financial situation than non-bankrupts in all industries, and the financial crisis among them increased over time, ultimately leading to bankruptcy. Furthermore, the variation in WO' values between industries confirms that different sectors of the economy respond differently to financial risk, indicating the need to adapt bankruptcy forecasting models to the specifics of each sector. The process of selecting companies for the test sample was done by random sampling using a random number generator (Excel), and the effectiveness of the bankruptcy forecasting models was verified on

the basis of the test sample. In order to ensure the representativeness of the different industries in the study, the sampling process was carried out separately for the retail, manufacturing and service industries, which allowed for a balance between the number of observations and their industry distribution.

The fifth chapter is devoted to describing the results of the research conducted based on constructed (and estimated) bankruptcy forecasting models. The chapter discusses more than 100 bankruptcy forecasting models that were constructed for different sets of discriminating variables and estimated on differently specified learning sets.

At the application layer, three recommendations can be made. The first postulate is the use of industry-based bankruptcy prediction models in economic practice. Research has shown that industry differentiation significantly increases the predictive capacity of models. The use of such a form allows for more precise identification of entities at risk of bankruptcy. The second recommendation is to include the small and medium-sized enterprise sector in a systemic mechanism for early identification of bankruptcy symptoms. Research has shown that it is these smaller entities that are more exposed to this phenomenon. The last recommendation is related to the period in which bankruptcy symptoms appear. The study showed that its prediction is significantly influenced by financial indicators and non-financial factors from the year prior to the bankruptcy filing. Therefore, the prediction analysis should be conducted primarily on the basis of data covering the current and preceding financial year.

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