Wiadomości Statystyczne. The Polish Statistician, 2021, vol. 66, 6, 7–26 DOI: 10.5604/01.3001.0014.9701
Statystyka w praktyce / Statistics in practice
Otrzymano/received: 9.04.2021, zaakceptowano/accepted: 4.06.2021

Is it worth restructuring? Analysis of companies in poor financial condition in Poland

Sergiusz Herman[a]

Abstract. Deteriorating financial condition of a company may lead to insolvency. As a result, the company may be declared bankrupt or undergo restructuring. The first goal of the study described in the paper is to compare the financial condition of Poland-based non-financial companies undergoing restructuring and bankruptcy processes. In the empirical study, a tool for forecasting the future financial situation of a company was constructed. The second goal is the assessment of the effectiveness of restructuring processes on the basis of a comparative analysis of companies subjected to varios forms of this procedure. An attempt was made to identify the determinants of the success or failure of the restructuring process.

The study was based on the information from the Coface Poland, EMIS Professional and the *Court and Commercial Gazette* (Pol. 'Polski Monitor Sądowy i Gospodarczy') databases. The empirical research was conducted on a random sample of financial data of 1740 non-financial companies (580 companies that were declared bankrupt, 580 companies undergoing a restructuring, and 580 companies in a good financial condition) in 2015–2019. The Kruskal-Wallis test, Dunn's test, Mann-Whitney's test and the random forest classifier were used for the purpose of the study.

Companies that were declared bankrupt or underwent a restructuring process have more in common with each other than with companies efficiently operating in the market. It was possible to create a classifier which enabled forecasting whether a company will have financial problems. The results of the study demonstrated that the efficiency of the restructuring process does not depend on financial factors. Moreover, restructuring often fails to protect companies from bankruptcy and does not have a significant impact on the financial condition of restructured entities.

Keywords: corporate bankruptcy, restructuring proceedings, financial condition
JEL: G33, G34, G38, C38

Czy restrukturyzacja ma sens? Analiza przedsiębiorstw w złej kondycji finansowej funkcjonujących na polskim rynku

Streszczenie. Pogarszająca się kondycja finansowa przedsiębiorstwa może doprowadzić do jego niewypłacalności, co z kolei może skutkować ogłoszeniem upadłości lub restrukturyzacją przedsiębiorstwa. Pierwszym celem badania omawianego w artykule jest porównanie kondycji finansowej przedsiębiorstw niefinansowych funkcjonujących w Polsce, które zostały poddane postępowaniu restrukturyzacyjnemu oraz upadłościowemu. W przeprowadzonym badaniu empirycznym skonstruowano narzędzia umożliwiające prognozowanie przyszłej sytuacji finansowej firmy. Drugim celem jest ocena efektywności restrukturyzacji na podstawie analizy porównawczej przedsiębiorstw poddanych różnym formom tego postępowania. Podjęto próbę identyfikacji determinant powodzenia lub porażki tego procesu.

[a] Uniwersytet Ekonomiczny w Poznaniu, Instytut Informatyki i Ekonomii Ilościowej, Polska / Poznań University of Economics and Business, Institute of Informatics and Quantitative Economics, Poland. ORCID: https://orcid.org/0000-0002-2753-1982. E-mail: sergiusz.herman@ue.poznan.pl.

W badaniu wykorzystano informacje z baz danych Coface Poland, EMIS Professional oraz „Monitora Sądowego i Gospodarczego". Analizę empiryczną przeprowadzono na podstawie danych finansowych 1740 przedsiębiorstw funkcjonujących w Polsce (580 firm, wobec których toczy się postępowanie upadłościowe, 580 firm przechodzących restrukturyzację i 580 firm w dobrej kondycji finansowej) za lata 2015–2019. Zastosowano w niej testy nieparametryczne: Kruskala-Wallisa, Dunna i Manna-Whitneya oraz klasyfikator lasu losowego.

Podobieństwo między przedsiębiorstwami, wobec których wszczęto postępowanie upadłościowe, i przedsiębiorstwami przechodzącymi restrukturyzację jest większe niż między każdą z tych grup a przedsiębiorstwami sprawnie działającymi w gospodarce. Klasyfikator skonstruowany na potrzeby badania umożliwił prognozowanie, czy przedsiębiorstwo będzie miało problemy finansowe. Uzyskane wyniki pozwoliły stwierdzić, że skuteczność procesu restrukturyzacji nie zależy od czynników finansowych. Postępowanie restrukturyzacyjne nie zawsze chroni firmy przed upadłością ani nie ma znaczącego wpływu na kondycję finansową tych podmiotów.

Słowa kluczowe: upadłość przedsiębiorstwa, postępowanie restrukturyzacyjne, kondycja finansowa

1. Introduction

The forecasting of companies' financial problems has been earning interest of both academics and entrepreneurs. If financial threats are noticed early enough, a company may avoid a crisis. It is crucial to have appropriate legal measures that secure the interests of creditors of companies facing financial difficulties and at the same time ensure efficient bankruptcy or restructuring processes. Because of the global financial crisis of 2007–2009, many governments have started paying attention to this issue. As a result, in many countries the legislation was changed so as to focus mostly on the restructuring processes which are a chance for indebted companies to avoid bankruptcy. Despite having a common goal, different legislators have offered different ways of achieving it: devising various definitions of insolvency, designing different and complex legal proceedings, and granting different rights to debtors and creditors. According to the literature, these are the key considerations when choosing between bankruptcy and restructuring (Wang, 2012).

This article contributes to the literature in two ways. The first goal of the paper is to compare the financial condition of non-financial companies in Poland undergoing restructuring and bankruptcy procedures. This will allow defining financial determinants showing which legal solutions should be applied in a given company. The results, in turn, will allow creating a classifier for forecasting financial situation of a company in the future. In contrast to the majority of research, this will not be a binary problem. The created classifier will make it possible to forecast whether a company will undergo restructuring or bankruptcy process, or it will operate efficiently.

The second goal of the study is the assessment of the effectiveness of restructuring processes on the basis of a comparative analysis of companies subjected to varios forms of this procedure. In addition to the above, the author made an attempt to

identify the determinants of a restructuring's success or failure. As mentioned above, the legislation regarding restructuring varies across the world. Literature review showed that the majority of such studies concerned the US market. In Poland, new regulations were introduced in 2016. Until this paper has been written, there had not been any such a comprehensive study for the Polish market.

2. Literature review

In literature, there has been a strong focus on the development of tools for forecasting company bankruptcy. In the early research on the topic, authors tried to forecast bankruptcy by analysing values of certain financial indicators separately (Beaver, 1966; Fitzpatrick, 1932; Smith & Winakor, 1935). The work of Altman (1968) proved to be a milestone in company bankruptcy forecasting. He was the first researcher to suggest a multidimensional discrimination analysis considering multiple variables in forecasting. In the following years, researchers used other classification methods such as logistic regression model (Martin, 1977), probit model (Zmijewski, 1984), neural networks (Odom & Sharda, 1990), genetic algorithm (Shin & Lee, 2002), or decision trees (Gepp & Kumar, 2015).

Recently, there has been a new trend in the methodology of company bankruptcy forecasting. It is based on a combined approach, which means using not one but a set of classifiers (models). Some researchers have used methods of combining the same classifiers such as bagging, boosting, random subspaces and random forest (Alessi & Detken, 2018; Antulov-Fantulin et al., 2021). Also, there is a lot of research on the use of heterogenous classifier sets (Geng et al., 2015; Kim, 2018; Kim & Upneja, 2021). According to some authors, combined methods are more advantageous than the traditional approach described earlier (du Jardin, 2018).

Irrespective of the method, all above-mentioned researchers treat forecasting of financial problems as a binary classification problem. The forecasting concerns two populations: companies in a good or a poor (various definitions) financial condition. The literature suggests that this approach is too generic as it does not reflect an actual situation of a company (Balcaen & Ooghe, 2006).

Regarding the restructuring process, researchers focus mostly on its efficiency, i.e. on how the introduction of such procedures impacts the companies' situation. The situation may be assessed differently. Some authors study the impact of legal proceedings on the financial condition of companies (Aivazian & Zhou, 2012; Alderson & Betker, 1999; Denis & Rodgers, 2007; Hotchkiss et al., 2008; Kalay et al., 2007). Others check how restructuring proceedings affected share prices (Ahmad et al., 2018; Komera & Jijo Lukose, 2013; Prusak & Potrykus, 2021). Altman tried to predict subsequent financial problems of companies that had been restructured (Altman & Branch, 2015; Altman et al., 2009). Several authors also aimed at identifying financial factors affecting the duration of a company with financial problems

(Ayadi et al., 2021; Cepec & Grajzl, 2020); still other research focused on identifying determinants of a successful or unsuccessful restructuring process and forecasting the result (Ahmad, 2019).

3. Restructuring process under Polish law

The problem of restructuring is not new in Poland. Such corrective actions were determined in the Act of 28 February 2003 on bankruptcy (Pol. Ustawa z dnia 28 lutego 2003 r. – Prawo upadłościowe; further referred to as 'the Bankruptcy Law'). However, it was not until a separate act – the Act of 15 May 2015 on restructuring (Pol. Ustawa z dnia 15 maja 2015 r. – Prawo restrukturyzacyjne; further referred to as 'the Restructuring Law'), was adopted, that restructuring became a very popular solution in the economy. The act entered into force on 1 January 2016 and introduced new types of restructuring in Poland. Since, as mentioned above, it is a separate act, it defines only one type of bankruptcy – an equivalent of the procedure of liquidation of the debtor's assets.

There were many reasons to introduce new regulations. The previous liquidation procedures were barely used. In many cases, insolvent entrepreneurs were simply out of the market as a result of an informal liquidation, which was unfavourable for creditors. Moreover, under the previous law, once a company declared bankruptcy, it was no longer able to operate, even if the bankruptcy allowed for the conclusion of the agreement. A company had to add the 'arrangement bankruptcy' phrase to its name, which often negatively affected its perception by clients and other enterprises. Creditors were usually not interested in making any agreements with debtors.

The restructuring procedure starts at the request of the debtor, which can be already insolvent or threatened with insolvency. According to the Restructuring Law, the aim of the process is to avoid the debtor's bankruptcy. It is done by arranging agreements with creditors or by business-reforming actions. There are four types of restructuring process:

- arrangement approval process;
- accelerated (fast-track) arrangement process;
- arrangement process;
- remedial process.

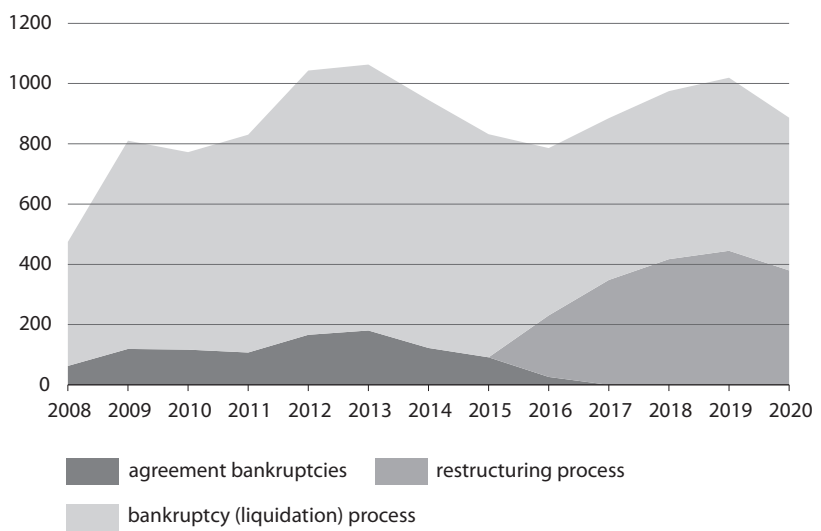
Restructuring procedures differ in terms of duration and complexity. Arrangement approval is the simplest of them, as it allows the debtor to get votes of creditors out-of-court. The following two of the above procedures enable the debtor to make an arrangement with the creditor after a list of debts is done and approved. The difference between them is that in the case of arrangement process, creditors may object to the list of debts created by a supervisor, which in turn might prolong the procedure. Remedial process, on the other hand, is the longest and most complex. Unlike in the case of the other above-mentioned types of restructuring, the debtor

using it may take reforming actions, i.e. legal and factual actions aimed at improving the debtor's economic situation and making it possible to operate while suspending enforcement of debt repayment. Remedial procedure is intended for debtors in a poor financial condition.

Restructuring process is completed as of the date of making an arrangement or refusing it. Also, the court may discontinue the proceedings when, for instance, their results are unfavorable for creditors, an arrangement is rejected, or a debtor requested discontinuation and the creditor board accept it.

In the introduction to this paper it was mentioned that changes in legislation increased the popularity of restructuring in Poland. This conclusion was drawn after the analysis of the application of this solution in previous years (Figure 1). It shows that the number of restructurings has grown almost immediately after the new legislation was introduced.

Figure 1. Bankruptcies and restructurings in Poland



Source: author's work based on: Coface (2021).

The exception is the year 2020. The trend reversed because many companies chose the new, out-of-court and simplified procedures for arrangement approval, which were introduced by the COVID-19 Act of 19 June 2020 (Pol. Ustawa z dnia 19 czerwca 2020 r. o dopłatach do oprocentowania kredytów bankowych udzielanych przedsiębiorcom dotkniętym skutkami COVID-19 oraz o uproszczonym postępowaniu o zatwierdzenie układu w związku z wystąpieniem COVID-19) and are meant as temporary provisions.

4. Research method

The empirical study required an appropriate research sample representing three separate populations: companies that were declared bankrupt (further referred to as 'bankrupts'), companies undergoing restructuring ('restructured') and companies operating in the market, in a good financial condition ('healthy'). Companies were classified in one of the first two groups on the basis of a court's decision to start certain proceedings. To prepare a research sample for the first two groups, three databases were used: the database of Coface Poland, the EMIS Professional database, and data from the *Court and Commercial Gazette* (Pol. 'Monitor Sądowy i Gospodarczy'). Taking into account data availability, the author randomly chose 580 companies which were declared bankrupt and 580 companies that started restructuring in years 2016–2020. Table 1 presents the structure of the research sample in terms of the number of companies from the three groups defined above, in particular research years.

Table 1. Companies used in research sample

Year	Restructured	Bankrupt / in liquidation	Healthy
2016	62	115	88
2017	122	123	124
2018	152	100	126
2019	161	151	156
2020	83	91	86
Total	580	580	580

Source: author's calculation based on: Coface Poland (2021) and 'Monitor Sądowy i Gospodarczy' (2021).

Table 2 presents the number of restructuring processes of different types foreseen by Polish law for each year covered by the study.

Table 2. Companies in research sample by the type of restructuring

Year	Arrangement approval process	Accelerated (fast-track) arrangement process	Arrangement process	Remedial process
2016	1	25	9	27
2017	5	60	17	40
2018	4	82	23	43
2019	2	88	13	58
2020	2	40	9	32
Total	14	295	71	200

Source: author's calculation based on: Coface Poland (2021) and 'Monitor Sądowy i Gospodarczy' (2021).

Financial data of those companies (which were declared bankrupt and which started restructuring), and also data of 580 companies in a good financial condition (in the studied period) were used in the study. In the empirical research, 13 financial ratios reflecting profitability, efficiency, liquidity and funding structure of enterprises were calculated and used (Table 3).

Table 3. Financial ratios used in the survey

Operating area	Financial ratio	Formula
Profitability	return on assets (ROA) in %	net profit ÷ total assets
	return on sales (ROS) in %	net profit ÷ sales revenues
	gross profit/assets in %	gross profit ÷ total assets
Efficiency	inventory turnover in days	average value of inventories ÷ net sales revenues · 365
	accounts receivable turnover in days	average value of receivables ÷ net sales revenues · 365
	trade payables turnover in days	average value of trade payables ÷ net sales revenues · 365
Liquidity	current ratio	short-term assets ÷ short-term liabilities
	quick ratio	(current assets – inventories) ÷ short-term liabilities
	cash ratio	(working assets – inventories-receivables) ÷ short-term liabilities
	working capital to total assets ratio in %	working capital ÷ total assets
Funding structure	debt to total assets ratio in %	debt ÷ total assets
	debt to equity ratio in %	debt ÷ equity capital
	equity to assets ratio in %	equity capital ÷ total assets

Source: author's work.

Since all the studied financial positions were not normally distributed, three non-parametric tests were used to compare the groups: the Kruskal-Wallis test, Dunn's test and Mann-Whitney's test. They were used to determine whether the level of financial indicators have the same distribution. In order to create a classifier, one of the machine-learning tools, i.e. a random forest, was applied. The results of other studies show that random forest models often outperform other techniques (Barboza et al., 2017; Petropoulos et al., 2020; Tanaka et al., 2019).

The random forest method involves constructing a number of classification trees based on randomly chosen variables used for the construction of a single tree and a random set of objects used for its learning. Each of these classification trees is used to classify objects that were not employed to construct it. As a result, each observation is classified by a multitude of trees and a final decision on its classification is based on the use of an aggregation method – the majority vote. Therefore, the object is assigned to a class (population) which was indicated by the highest number of trees in a forest (Breiman, 2001; Calderoni et al., 2015).

Let us assume that our sample consists of N objects that are determined by M variables, and D is the number of trees in a random forest. The forest algorithm can be presented as follows:

- each $d = 1, 2, \ldots, D$ tree from the training set is drawn with the return of N objects – a bootstrap sample;
- for each bootstrap sample, the classification tree (without pruning) is constructed in the following way:
  - m variables ($m \ll M$) without replacements are drawn in each node;
  - for m sampled variables, the best division (which results in the most homogeneous sub-nodes) of observations in the node is determined and the node is divided accordingly;
- each object is classified with the use of trees which were not constructed by this object;
- each object is eventually assigned to the class indicated by the highest number of trees in the previous part of the algorithm.

It can be measured how each feature decreases the impurity (measure of the homogeneity of the labels at the node) of the split. For each feature it can be measured to what extent on average it decreases the impurity. The average over all trees in the forest is the measure of the feature importance.

Due to the fact that objects are classified using classification trees constructed without the use of a given object, the random forest method is more stable in terms of the forecast quality for objects from learning and testing samples.

Four variables were drawn in each mode (literature suggests using the $\sqrt{M}$ of the adopted variables). It was assumed that the Gini index is the measure of class diversity in a node. All calculations were made with the use of the R statistical environment.

5. Outline and results of the study

The first goal of the study was to compare the financial condition of companies in the year preceding the decision to declare bankruptcy or to restructure. The numbers are presented in Table 4. The analysis showed that in the vast majority of cases, the groups have a significantly different distribution of studied financial positions. Companies that were declared bankrupt were the smallest, obtained the lowest revenues and had the poorest financial results. At the same time, those entities had the lowest long-term and short-term debts. Companies undergoing restructuring were of medium size and obtained medium-volume revenues. Like in the case of the previous group, these companies sustained the financial loss. What is interesting, they had highest debts among all the analysed groups.

Next, the author compared the financial condition of the studied companies using 13 financial indicators (Table 5). They represented four most important areas of operations, i.e. profitability, efficiency, liquidity and funding structure[1]. As before, non-parametric tests were used for the comparison. The results demonstrate that groups differed in terms of the distribution of the studied variables. Companies that were declared bankrupt had the lowest profitability and liquidity. For the same areas of operations, companies undergoing the restructuring had medium results. Companies successfully operating in the market, on the other hand, were in the best financial condition taking into account all the analysed aspects. The data presented in the table demonstrates that companies which were declared bankrupt or underwent restructuring process in the following year share more similarities with each other than compared to companies efficiently operating in the market.

Table 4. Comparative analysis of chosen financial positions for the studied groups (healthy, bankrupts, restructured companies)

Specification		Total assets	Total operating revenue	Net profit (loss)	Total liabilities	Long-term debt	Short-term debt	Debt	Total equity
		in mln PLN							
Healthy	mean	14.34	24.34	1.07	7.51	1.93	5.58	1.91	6.82
	median	4.35	9.24	0.35	2.20	0.12	1.85	0.24	1.65
	max.	1162.62	2165.09	52.53	539.94	185.18	528.33	190.94	622.68
	min.	0.16	0.54	–0.73	0.01	0.00	0.00	0.00	–13.99
Bankrupts	mean	5.14	9.17	–1.22	6.32	1.29	5.03	2.08	–1.18
	median	0.85	1.20	–0.15	1.16	0.03	0.87	0.20	–0.10
	max.	227.09	1010.39	5.18	374.62	112.64	365.52	180.87	94.21
	min.	0.01	0.01	–196.74	0.01	0.00	0.00	0.00	–178.66
Restructured	mean	20.64	25.67	–2.18	19.10	5.72	13.38	7.03	2.00
	median	3.96	4.20	–0.14	3.87	0.45	2.74	0.98	0.23
	max.	670.24	1408.96	58.76	768.40	573.76	383.00	304.39	210.66
	min.	0.02	0.01	–186.97	0.07	0.00	0.01	0.00	–151.87
H-statistics		311.46*	526.60*	689.69*	156.18*	120.43*	134.26*	174.68*	471.68*
Statistically significant differences		H-B; B-R	all of them	H-B; H-R	all of them	all of them	all of them	H-R; B-R	all of them

Note. * – significant at the level of $\alpha = 0.05$. *H*-statistics – based on the Kruskal-Wallis test. Statistically significant differences – based on Dunn's test. H – healthy, B – bankrupts, R – restructured.

Source: author's calculation based on: EMIS Professional (2021).

[1] The author decided against using the ROE indicator. The sample included companies that sustained loss while having a negative equity value. Therefore, the calculated positive ROE was not comparable with other companies.

Table 5. Comparative analysis of chosen financial indicators for the studied groups of companies

Financial ratio	Healthy		Bankrupts		Restructured		*H*-statistics	Statistically significant differences
	mean	median	mean	median	mean	median		
Return on assets (ROA) in %	10.57	6.39	−106.94	−24.35	−28.46	−6.19	757.22*	all of them
Return on sales (ROS) in %	5.00	2.88	−95.80	−18.36	−56.68	−4.71	695.86*	all of them
Gross profit/assets in %	11.78	7.54	−120.06	−25.51	−1931.89	−6.43	768.25*	all of them
Inventory turnover in days	32.63	17.93	317.49	9.04	572.90	24.62	32.24*	H-R; B-R
Accounts receivable turnover in days	43.41	37.50	232.10	35.70	357.35	44.06	14.12*	H-R; B-R
Trade payables turnover in days	25.09	2.36	657.24	15.48	1017.47	33.77	172.16*	all of them
Current ratio	6.17	1.42	1.19	0.53	1.19	0.76	467.71*	all of them
Quick ratio	2.86	1.09	0.98	0.37	0.75	0.46	385.20*	all of them
Cash ratio	1.62	0.08	0.13	0.01	0.09	0.01	167.86*	H-B; B-R
Working capital to total assets ratio in %	21.16	20.76	−178.16	−40.00	−49.41	−13.97	501.58*	all of them
Debt to total assets ratio in %	14.54	6.09	85.16	22.91	41.52	27.97	177.29*	all of them
Debt to equity ratio in %	138.33	10.39	189.79	0.00	133.91	34.05	126.87*	H-B; B-R
Equity to assets ratio in %	40.44	41.09	−250.53	−17.08	−30.01	8.32	538.72*	all of them

Note. As in Table 4.

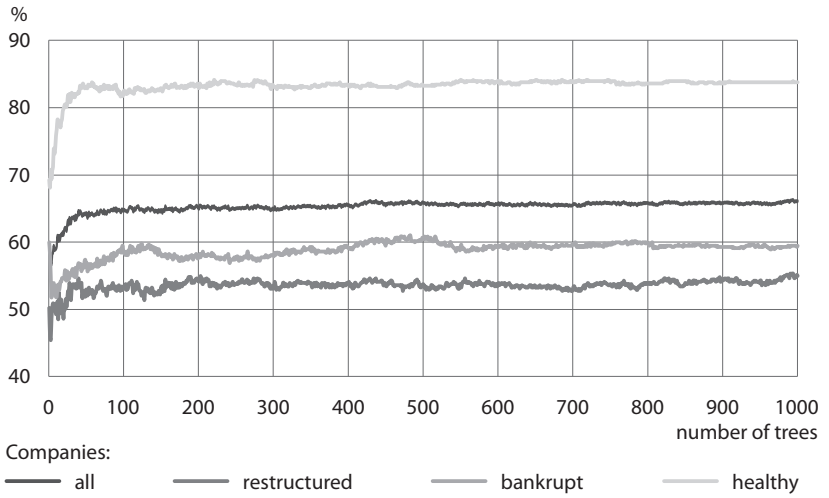
Source: author's calculation based on: EMIS Professional (2021).

As mentioned in the introduction, the next step of the empirical study was to design a tool for forecasting future financial situation of a company. The author wanted to create a classifier for predicting whether a company will have financial problems, i.e. will be declared bankrupt or will undergo restructuring procedure. For this purpose, the study included random forest and a set of financial indicators compared in Table 5. Figure 2 presents classification accuracy for the analysed company groups after adding more trees to the random forest.

The highest global value of the accuracy indicator at the level of 67.73% was noted for all the studied companies, the level of 53.59% for companies undergoing restructuring, 67.16% for bankrupts, and 84.67% for companies operating successfully in the market.

The classification matrix for a random forest created on the basis of 1,000 trees can be found below (Table 6). The results show that the global accuracy of this classifier is 66.09% for an out-of-bag sample. The tool works best for identifying companies in a good financial condition (accuracy at the level of 83.79%).

Figure 2. Accuracy of classification of companies with the use of random forest



Source: author's calculation based on: EMIS Professional (2021).

Table 6. Classification accuracy for three analysed company groups

Actual class	Predicted class of companies			Accuracy in %
	restructured	bankrupts	healthy	
Restructured	319	183	78	55.00
Bankrupt	189	345	46	59.48
Healthy	78	16	486	83.79
Global	.			66.09

Source: author's calculation based on: EMIS Professional (2021).

This tool makes it possible to distinguish companies which will have financial difficulties (bankruptcy or restructuring) within the following year from companies operating successfully in the market. The classifier is less efficient when forecasting whether a company will be declared bankrupt or will undergo restructuring process. This result complies with the expectations. Companies undergoing bankruptcy or the restructuring are in a financial condition relatively similar to each other and relatively different from healthy companies, which was demonstrated in the analysis of the results in Table 5.

By means of the results from the random forest, the author determined the importance of certain variables used in the study (Table 7). A given variable is valid if it is often used for the classification of objects from the training set.

Table 7. Importance of financial indicators describing companies' situation used in the random forest

Financial ratio	Variable importance
Gross profit/assets in %	100.0
Return on assets (ROA) in %	84.6
Return on sales (ROS) in %	82.9
Equity to assets ratio in %	60.3
Working capital to total assets ratio in %	58.1
Accounts receivable turnover in days	47.8
Trade payables turnover in days	42.4
Current ratio	41.3
Debt to equity ratio in %	39.4
Debt to total assets ratio in %	38.4
Inventory turnover in days	37.9
Quick ratio	36.9
Cash ratio	25.2

Source: author's calculation based on: EMIS Professional (2021).

The results suggest that the most important variables for the classification of companies were profitability indicators, i.e. gross profit/assets, return on assets (ROA) and return on sales (ROS). Values of these indicators varied significantly across the studied groups (Table 5). The two liquidity indicators, on the other hand, turned out to be the least important for the classification (quick ratio and cash ratio).

The third part of the paper presented various restructuring types foreseen by Polish law. The decision of which type of restructuring to adopt is mostly the responsibility of the management of the entity (debtor). The types differ to the largest extent in terms of the procedure. For example, arrangement approval process is recommended for debtors without significant debts, whereas the remedial process should be used by companies in the worst financial condition.

In this part of the study, the author analysed the financial condition of companies undergoing various forms of restructuring a year before a given procedure was implemented. Results are presented in Table 8. They indicate that in the case of financial positions, the most significant statistical differences were observed between the values for companies undergoing the remedial process and those that adopted the arrangement procedure. The former were entities with a higher balance sheet, revenues, debts and equity. The analysis of the financial condition of the restructured companies showed that there is no significant statistical difference in values of the studied indicators in 12 out of 13 cases. The financial condition of a company a year before the restructuring does not have any impact on the applied restructuring form.

Table 8. Comparative analysis of a financial condition of companies undergoing different forms of restructuring

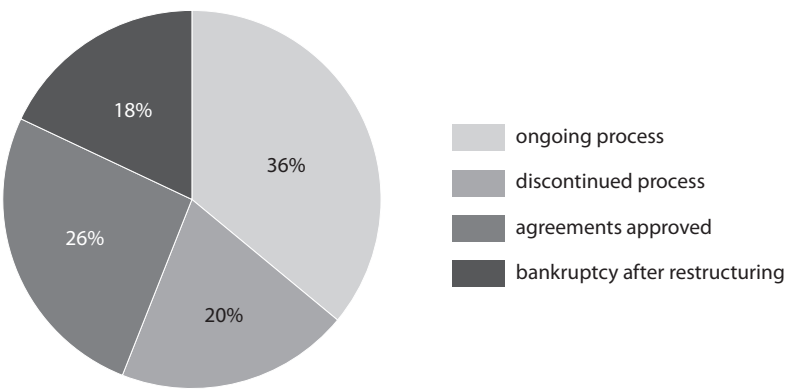
Specification	Remedial process (1)		Arrangement process (2)		Accelerated (fast-track) arrangement process (3)		Arrangement approval process (4)		*H*-statistics	Statistically significant differences
	mean	median	mean	median	mean	median	mean	median		
Total assets in mln PLN	26.63	6.47	13.68	2.94	17.94	3.20	27.42	4.12	19.91*	1–3
Total operating revenue in mln PLN	39.54	5.87	12.96	4.01	18.88	3.59	35.04	8.46	9.52*	1–3
Net profit (loss) in mln PLN	–2.80	–0.10	–1.97	–0.16	–1.82	–0.15	–2.09	–0.31	3.29	–
Total liabilities in mln PLN	23.58	6.07	12.15	3.71	17.46	3.07	25.15	5.24	17.38*	1–3
Long-term debt in mln PLN	6.85	0.83	2.17	0.16	5.99	0.33	1.88	0.58	19.65*	1–3; 1–2
Short-term debt in mln PLN	16.73	3.71	9.98	3.15	11.46	2.27	23.27	4.35	11.86*	1–3
Debt in mln PLN	8.84	1.69	3.18	0.69	6.57	0.76	10.56	0.78	12.05*	1–3; 1–2
Total equity in mln PLN	4.20	0.64	1.53	0.17	0.61	0.07	2.27	0.09	14.47*	1–3
Return on assets (ROA) in %	–28.66	–3.53	–52.10	–8.50	–21.63	–7.56	–49.53	–18.08	8.29*	–
Return on sales (ROS) in %	–59.41	–2.80	–29.84	–6.51	–62.29	–6.28	–35.53	–18.27	3.96	–
Gross profit/assets in %	–27.62	–3.86	–15,613.98	–8.21	–19.44	–7.31	–46.13	–16.35	6.09	–
Inventory turnover in days	514.77	19.03	831.84	22.92	572.96	29.26	88.76	27.41	2.87	–
Accounts receivable turnover in days	92.09	43.08	431.63	58.98	516.43	44.12	417.88	39.79	1.94	–
Trade payables turnover in days	589.90	35.40	213.96	35.14	1533.82	32.53	320.33	4.61	1.58	–
Current ratio	1.37	0.73	1.96	0.85	0.89	0.75	0.91	0.67	2.49	–
Quick ratio	0.59	0.44	1.72	0.57	0.62	0.45	0.74	0.50	4.59	–
Cash ratio	0.05	0.01	0.32	0.01	0.06	0.01	0.19	0.02	0.96	–
Working capital to total assets ratio in %	–33.33	–13.36	–79.92	–10.38	–53.04	–15.46	–47.82	–26.45	1.30	–
Debt to total assets ratio in %	32.99	30.65	29.52	24.84	51.10	28.21	22.55	7.57	9.87*	–
Debt to equity ratio in %	175.37	58.60	19.14	15.24	135.80	21.52	83.67	0.00	8.28*	1–3
Equity to assets ratio in %	–11.43	11.98	–59.03	8.02	–34.83	4.62	–46.84	7.24	5.47	–

Note. * – significant at the level of $\alpha = 0.05$. *H*-statistics – based on the Kruskal-Wallis test. Statistically significant differences – based on Dunn's test.

Source: author's calculation based on: EMIS Professional (2021).

Another aspect of the Restructuring Law that is worth mentioning is the efficiency of the procedures laid down in the act. This efficiency can be measured in two ways, depending on the defined goal of the restructuring processes. According to the explanatory memorandum to the act, one of them is the survival (as opposed to bankruptcy) of the restructured companies. In this case, the efficiency of the measures defined in the act may be examined on the basis of the research sample. The research concerned restructurings which started in the years 2016–2020. Due to the fact that the research spanned five years, restructured companies were at different stages of the process. Figure 3 shows the percentages of companies in different restructuring stages as of 31 December 2020.

Figure 3. Structure of companies at different stages of the restructuring process in 2016–2020



Source: author's calculation based on: Coface Poland (2021) and 'Monitor Sądowy i Gospodarczy' (2021).

As of 31 December 2020, out of 580 instances of restructuring, only 26% concluded with the approval of the arrangement. As many as 36% were cancelled in the midst of the process. Most concerningly, 18% of companies that started the restructuring declared bankruptcy in the following years. This group consisted of 83 companies for which the restructuring process was discontinued, and of 24 companies with the approved arrangement for their restructuring. The results are strongly dependent on the time of the study. For instance, if we take into account only restructurings that started in 2020, it would turn out that almost all of them were in progress (89% of the total). Therefore, for the purpose of this study, it makes more sense to analyse the progress of only those restructuring processes as of 31 December 2020 which started much earlier, e.g. in 2016–2017. In this case, it turns out that as many as 32.6% of all restructurings ended up in bankruptcy of a company.

The second important aspect of assessing the efficiency of a restructuring is its impact on the financial condition of a company. Bankrupt companies, despite having been restructured, were excluded from this part of the study. The financial condition of companies was compared in a four-year time span: the year before the restructuring started (value '–1'), the year when it started ('0'), and in the following two years ('1' and '2'). The medians of the financial indicators are presented in Table 9.

Table 9. Change of the financial condition of companies undergoing restructuring

Ratio	Year of operation of the enterprise				*H*-statistics	Statistically significant differences
	–1	0	1	2		
Return on assets (ROA) in %	–6.14	–14.03	–3.97	–4.36	36.08*	0 : others
Return on sales (ROS) in %	–6.26	–14.20	–7.17	–2.85	13.65*	0 : –1; 0 : 2
Gross profit/assets in %	–6.16	–13.49	–4.15	–2.35	38.15*	0 : others
Inventory turnover in days	23.11	19.24	27.30	20.20	1.61	–
Accounts receivable turnover in days	44.32	50.74	49.18	43.18	3.72	–
Trade payables turnover in days	30.15	29.44	38.46	36.65	0.09	–
Current ratio	0.76	0.51	0.50	0.43	35.89*	–1 : others
Quick ratio	0.46	0.34	0.34	0.33	14.42*	–1 : 0
Cash ratio	0.01	0.01	0.01	0.02	3.36	–
Working capital to total assets ratio in %	–14.23	–42.14	–41.06	–40.44	40.60*	–1 : 0; –1 : 1
Debt to total assets ratio in %	27.04	31.50	26.29	17.68	3.61	–
Debt to equity ratio in %	27.35	–2.72	0.00	–4.29	41.68*	–1 : others
Equity to assets ratio in %	6.90	–13.96	–15.84	–17.78	61.63*	–1 : others

Note. * – significant at the level of $\alpha = 0.05$. *H*-statistics – based on the Kruskal-Wallis test. Statistically significant differences – based on Dunn's test.

Source: author's calculation based on: EMIS Professional (2021).

According to the values in the table, the studied companies were in the worst financial condition in the year when the restructuring started. As a result of the proceedings, only the profitability of companies improved – companies became less unprofitable. Efficiency, liquidity and the employment structure did not improve compared to the year when the restructuring started.

According to Figure 3, 18% of all companies undergoing restructuring were declared bankrupt. Therefore, the next aim of the study was to identify determinants of a success or failure of the restructuring process, the former being identified with the approval of the arrangement between the debtor and creditors, and the former with the declaration of bankruptcy by a company which underwent prior restructuring. The identification of such determinants would help improve court settlements. It would enable the differentiation between companies for which restructuring could yield positive results and those that should be declared bankrupt straight away. To define such determinants, the author compared the financial condition of companies

a year before the restructuring started. More specifically, two groups of entities were compared: those for which the arrangement was approved and companies that had been declared bankrupt by 31 December 2020. The results are presented in Table 10.

Table 10. Comparison of the financial condition of companies based on the effects of restructuring

Ratio	Bankruptcy after restructuring		Agreement approval		*Z*-statistics
	mean	median	mean	median	
Return on assets (ROA) in %	–27.32	–7.76	–20.73	–6.54	–0.24
Return on sales (ROS) in %	–20.06	–1.88	–23.45	–4.81	1.13
Gross profit/assets in %	–26.30	–8.20	–15.35	–6.32	–0.81
Inventory turnover in days	73.57	24.05	217.65	36.06	–0.74
Accounts receivable turnover in days	59.85	44.12	113.95	41.04	–0.29
Trade payables turnover in days	122.73	45.72	302.06	29.12	0.62
Current ratio	0.82	0.75	0.99	0.74	–0.03
Quick ratio	0.56	0.43	0.70	0.43	0.37
Cash ratio	0.05	0.01	0.07	0.02	0.25
Working capital to total assets ratio in %	–34.11	–15.33	–66.01	–15.21	0.09
Debt to total assets ratio in %	33.59	30.30	51.65	24.83	0.88
Debt to equity ratio in %	80.90	58.51	287.17	20.74	1.59
Equity to assets ratio in %	–11.96	12.91	–51.80	5.82	1.39

Note. *Z*-statistics – based on Mann-Whitney's test.

Source: author's calculation based on: EMIS Professional (2021).

The results demonstrate that for all financial indicators there was no statistically significant difference in the distribution of their values between the two analysed company groups. Therefore, the financial condition of the company a year before the restructuring started does not indicate whether they will succeed or fail. Other, non-financial determinants decide whether a company will be efficiently restructured or will go bankrupt.

6. Conclusions

Due to the competition on the market, globalisation and the lack of stability in and outside the country, companies face considerable risks. Lack of accurate action on the management's part may lead to insolvency of a company which in turn may result in bankruptcy or restructuring. Therefore, the study of the financial condition of companies should be of a great interest to various stakeholders, including company owners, employees, managers, creditors and suppliers.

The empirical study examined financial problems of companies operating in Poland in the years 2016–2020. Compared to other research concerning the Polish capital market, this study was not solely focused on bankruptcies. The analysis of

very popular types of restructuring (that have already been available for five years) was carried out. The author performed a comprehensive comparative analysis of the financial condition of companies undergoing different court procedures. As a result, it was possible to create a classifier which, unlike other research available, made it possible to forecast whether a company will have financial problems in the future, and if yes, which type of court procedure should be undertaken. For this purpose, the study employed a random forest method. The results show that the global accuracy of this classifier is 66.09%.

The second part of the study features the analysis of the financial condition of companies undergoing various types of restructuring in Poland, and the efficiency of these processes. The results are not optimistic. It turns out that restructuring rarely protects companies from bankruptcy or has any significant impact on their financial condition. According to the study's findings, only three financial indicators improve as a result of restructuring in Poland. Studies from other countries (presented in the literature review) revealed a more significant and positive impact of restructuring processes on the financial condition of the studied companies.

The analysis of the results moreover demonstrated that the success or failure of a restructuring does not solely depend on the financial condition of companies. It means that other non-financial factors, such as the efficiency and knowledge of restructuring advisors, or the willingness of creditors to cooperate, are likely to be more helpful for companies with financial problems. Other studies from across the world prove that it is possible to identify the determinants of a success or failure of the restructuring process.

The results of this research could be more comprehensive if the research period was longer. However, this is presently impossible, as the restructuring law in Poland has only been in force since 2016. It would also be interesting to see what happens if the study additionally examined non-financial factors such as stock exchange returns. On the other hand, it would be problematic, as the vast majority of the studied companies are not listed on the stock exchange.

References

Ahmad, A. H. (2019). What factors discriminate reorganized and delisted distressed firms: Evidence from Malaysia. *Finance Research Letters*, *29*, 50–56. https://doi.org/10.1016/j.frl.2019.03.010.

Ahmad, A. H., Abdullah, N. A. H., & Taufil Mohd, K. N. (2018). Long-run performance of firms emerging from financial distress: Empirical evidence from Malaysia. *Economics and Business Letters*, *7*(1), 47–54. https://doi.org/10.17811/ebl.7.1.2018.47-54.

Aivazian, V. A., & Zhou, S. (2012). Is Chapter 11 Efficient?. *Financial Management*, *41*(1), 229–253. https://doi.org/10.1111/j.1755-053X.2012.01196.x.

Alderson, M. J., & Betker, B. L. (1999). Assessing Post-Bankruptcy Performance: An Analysis of Reorganized Firms' Cash Flows. *Financial Management*, *28*(2), 68–82. https://doi.org/10.2307/3666196.

Alessi, L., & Detken, C. (2018). Identifying excessive credit growth and leverage. *Journal of Financial Stability*, *35*, 215–225. https://doi.org/10.1016/j.jfs.2017.06.005.

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance*, *23*(4), 589–609. https://doi.org/10.2307/2978933.

Altman, E. I., & Branch, B. (2015). The bankruptcy system's chapter 22 recidivism problem: How serious is it?. *Financial Review*, *50*(1), 1–26. https://doi.org/10.1111/fire.12058.

Altman, E. I., Kant, T., & Rattanaruengyot, T. (2009). Post-Chapter 11 Bankruptcy Performance: Avoiding Chapter 22. *Journal of Applied Corporate Finance*, *21*(3), 53–64. https://doi.org/10.1111/j.1745-6622.2009.00239.x.

Antulov-Fantulin, N., Lagravinese, R., & Resce, G. (2021). Predicting bankruptcy of local government: A machine learning approach. *Journal of Economic Behavior and Organization*, *183*, 681–699. https://doi.org/10.1016/j.jebo.2021.01.014.

Ayadi, R., Abid, I., & Guesmi, K. (2021). Survival of reorganized firms in France. *Finance Research Letters*, *38,* 1–6. https://doi.org/10.1016/j.frl.2020.101434.

Balcaen, S., & Ooghe, H. (2006). 35 years of studies on business failure: An overview of the classic statistical methodologies and their related problems. *British Accounting Review*, *38*(1), 63–93. https://doi.org/10.1016/j.bar.2005.09.001.

Barboza, F., Kimura, H., & Altman, E. (2017). Machine learning models and bankruptcy prediction. *Expert Systems with Applications*, *83*, 405–417. https://doi.org/10.1016/j.eswa.2017.04.006.

Beaver, W. H. (1966). Financial Ratios as Predictors of Failure. *Journal of Accounting Research*, *4*, 71–111. https://doi.org/10.2307/2490171.

Breiman, L. (2001). Random Forests. *Machine Learning*, *45*(1), 5–32. https://doi.org/10.1023/A:1010933404324.

Calderoni, L., Ferrara, M., Franco, A., & Maio, D. (2015). Indoor localization in a hospital environment using Random Forest classifiers. *Expert Systems with Applications*, *42*(1), 125–134. https://doi.org/10.1016/j.eswa.2014.07.042.

Cepec, J., & Grajzl, P. (2020). Debt-to-equity conversion in bankruptcy reorganization and post-bankruptcy firm survival. *International Review of Law and Economics*, *61,* 1–13. https://doi.org/10.1016/j.irle.2019.105878.

Coface. (2021). *Raport roczny Coface: Niewypłacalności firm w Polsce w 2020 roku*. Warszawa. https://www.coface.pl/Aktualnosci-i-media/Biuro-prasowe/Roczny-raport-upadlosciowy-Coface-Niewyplacalnosci-przedsiebiorstw-w-Polsce-w-2020-roku.

Coface Poland. (2021). *Ogólnopolski Informator Upadłości i Restrukturyzacji Coface*. https://www-1emis-1com-10000f34800e7.han3.ue.poznan.pl/localui/interiu/index/.

Denis, D. K., & Rodgers, K. J. (2007). Chapter 11: Duration, Outcome, and Post-Reorganization Performance. *The Journal of Financial and Quantitative Analysis*, *42*(1), 101–118. https://doi.org/10.1017/S0022109000002209.

EMIS Professional. (2021). https://www.emis.com/pl.

Fitzpatrick, F. (1932). A Comparison of Ratios of Successful Industrial Enterprises with Those of Failed Firm. *Certified Public Accountant*, *6*, 727–731.

Geng, R., Bose, I., & Chen, X. (2015). Prediction of financial distress: An empirical study of listed Chinese companies using data mining. *European Journal of Operational Research*, *241*(1), 236–247. https://doi.org/10.1016/j.ejor.2014.08.016.

Gepp, A., & Kumar, K. (2015). Predicting Financial Distress: A Comparison of Survival Analysis and Decision Tree Techniques. *Procedia Computer Science*, *54*, 396–404. https://doi.org/10.1016/j.procs.2015.06.046.

Hotchkiss, E. S., John, K., Mooradian, R. M., & Thorburn, K. S. (2008). Chapter 14 – Bankruptcy and the Resolution of Financial Distress. In B. Espen Eckbo (Ed.), *Handbook of Empirical Corporate Finance* (pp. 235–287). Amsterdam: Elsevier B.V. https://doi.org/10.1016/B978-0-444-53265-7.50006-8.

du Jardin, P. (2018). Failure pattern-based ensembles applied to bankruptcy forecasting. *Decision Support Systems*, *107*, 64–77. https://doi.org/10.1016/j.dss.2018.01.003.

Kalay, A., Singhal, R., & Tashjian, E. (2007). Is Chapter 11 costly?. *Journal of Financial Economics*, *84*(3), 772–796. https://doi.org/10.1016/j.jfineco.2006.04.001.

Kim, S. Y. (2018). Predicting hospitality financial distress with ensemble models: the case of US hotels, restaurants, and amusement and recreation. *Service Business*, *12*(3), 483–503. https://doi.org/10.1007/s11628-018-0365-x.

Kim, S. Y., & Upneja, A. (2021). Majority voting ensemble with a decision trees for business failure prediction during economic downturns. *Journal of Innovation and Knowledge*, *6*(2), 112–123. https://doi.org/10.1016/j.jik.2021.01.001.

Komera, S., & Jijo Lukose, P. J. (2013). No longer sick: what does it convey? An empirical analysis of post-bankruptcy performance. *International Journal of Emerging Markets*, *8*(2), 182–202. https://doi.org/10.1108/17468801311307055.

Martin, D. (1977). Early warning of bank failure: A logit regression approach. *Journal of Banking and Finance*, *1*(3), 249–276. https://doi.org/10.1016/0378-4266(77)90022-X.

Monitor Sądowy i Gospodarczy. (2021). https://ems.ms.gov.pl/msig/przegladaniemonitorow.

Odom, M. D., & Sharda, R. (1990). A neural network model for bankruptcy prediction. In *1990 IJCNN International Joint Conference on Neural Networks*. https://doi.org/10.1109/ijcnn.1990.137710.

Petropoulos, A., Siakoulis, V., Stavroulakis, E., & Vlachogiannakis, N. E. (2020). Predicting bank insolvencies using machine learning techniques. *International Journal of Forecasting*, *36*(3), 1092–1113. https://doi.org/10.1016/j.ijforecast.2019.11.005.

Prusak, B., & Potrykus, M. (2021). Short-Term Price Reaction to Filing for Bankruptcy and Restructuring Proceedings—The Case of Poland. *Risks*, *9*(3), 1–14. https://doi.org/10.3390/risks9030056.

Shin, K. S., & Lee, Y. J. (2002). A genetic algorithm application in bankruptcy prediction modeling. *Expert Systems with Applications*, *23*(3), 321–328. https://doi.org/10.1016/S0957-4174(02)00051-9.

Smith, R. F., & Winakor, A. H. (1935). *Changes in the financial structure of unsuccessful industrial corporations*. Urbana: University of Illinois.

Tanaka, K., Higashide, T., Kinkyo, T., & Hamori, S. (2019). Analyzing Industry-Level Vulnerability by Predicting Financial Bankruptcy. *Economic Inquiry*, *57*(4), 2017–2034. https://doi.org/10.1111/ecin.12817.

Ustawa z dnia 28 lutego 2003 r. Prawo upadłościowe (Dz.U. 2003 nr 60 poz. 535).

Ustawa z dnia 15 maja 2015 r. – Prawo restrukturyzacyjne (Dz.U. 2015 poz. 978).

Ustawa z dnia 19 czerwca 2020 r. o dopłatach do oprocentowania kredytów bankowych udzielanych przedsiębiorcom dotkniętym skutkami COVID-19 oraz o uproszczonym postępowaniu o zatwierdzenie układu w związku z wystąpieniem COVID-19 (Dz.U. 2020 poz. 1086).

Wang, C. A. (2012). Determinants of the Choice of Formal Bankruptcy Procedure: An International Comparison of Reorganization and Liquidation. *Emerging Markets Finance and Trade*, *48*(2), 4–28. https://doi.org/10.2753/REE1540-496X480201.

Zmijewski, M. E. (1984). Methodological Issues Related to the Estimation of Financial Distress Prediction Models. *Journal of Accounting Research*, *22*, 59–82. https://doi.org/10.2307/2490859.