

The use of early warning models in the verification procedure of the going concern principle

Michał Gnap¹, Rafał Pitera²

¹Deloitte Assurance Sp. Z o.o.,
Poland

²Department of economy and finance, University of Rzeszow
Poland

Abstract - A key issue in making management decisions is the assessment of future business opportunities. This problem is also addressed as one of the areas during the audit of the financial statements. It is also one of the most important aspects of the operational activities of credit institutions financing the activities of companies. Therefore, as an extremely important aspect in the literature of the subject and economic practice, is correct and reliable assessment of the current financial situation of entities, and assessment of their future financial standing. To identify early factors and symptoms of the risk of going concern, the managers of entities and external stakeholders should use a range of well-known and important effective tools to assess the ability of going concern. The article addresses the issue of the assessment of the future operation of the company in accordance with the going concern principle. In addition, the most common tools of discriminatory models have been assessed in terms of their usefulness in view of their prognostic effectiveness.

Keywords: Going concern principle, early warning models, financial analysis, bankruptcy.

I. INTRODUCTION

The problem of the going concern is widespread. The reasons for the operational problem of the entity can be diverse. The last three years of economic turbulence have made companies increasingly difficult for companies to regulate their commitments. According to the Central Economic Information Center data, in 2022 the number of insolvent companies (being bankrupt or being forced) to carry out formal restructuring has risen to record 2739, which is 21% compared to the previous year (Centralny Ośrodek Informacji Gospodarczej, 2022). Allianz Trade predicts that in 2023 it will be even worse – the

number of insolvent companies is expected to increase by another 30%, i.e., to around 3 500. This shows that the risk of bankruptcy in the economy is growing significantly. A company may suffer financial difficulties not only for market reasons (e.g., poor demand) but also become victims of payment congestion - one of many returning domino cubes - even though it itself has a relatively healthy foundation. This means that company boards should now pay particular attention to the risks associated with their liquidity – monitoring it and building a system to respond to potential problems, from the formal and legal point of view (Allianz Trade, 2023). According to the results of a study commissioned by the law firm Grant Thornton and a specialist firm in the restructuring advice Filipiak Babicz Legal Sp.k., in the current economic climate, the risk of bankruptcy is a major and at least a real threat to many companies. More than one fifth (22%) of the surveyed members of the boards of medium and large enterprises operating in Poland admit that they fear that their organization will be forced to declare bankruptcy in two years' time. In fact, one in eight (12%) surveyed members said they saw this risk in the next year, and one in hundred fears that it will become in the next six months. Only a little more than half (55%) of the surveyed members of the boards of medium and large companies claim that there is no risk of bankruptcy (bankier.pl, 2023).

That is why authors decided to assess which early warning model could be the most effective to predict going concern perturbations in the nearest future.

Financial statements and data are one of the main areas of information based on which decisions are taken by managers and stakeholders. Based on the information contained in the



financial statements, primary users can obtain several details on the current financial situation. They may also make an assessment related to the entity's going concern. In view of the above, the objective of this chapter is to:

- an attempt to demonstrate whether and how early warning models can be used in assessing the financial performance of companies and;
- the answer to the question, whether their prognostic effectiveness is high enough to allow the results obtained to be used as a basis for the going concern assessment.

The chapter provides a theoretical review of the characteristics of the principle of going concern of business and the presentation of discriminatory models. The practical part is the results of a study on the use of discriminatory models to assess the going concern.

II. CHARACTERISTICS OF THE GOING CONCERN PRINCIPLE

When preparing financial statements, an enterprise must comply with certain rules that are set out in the Accounting Act. Regardless of what detailed arrangements are adopted in an entity, each entity must comply with the so-called primary accounting policies. Such principles include (Art. 4 of the Accounting Act of 29 September 1994):

- the principle of fair a true view;
- the principle of substance over form;
- the principle of materiality;
- the principle of going concern;
- the accrual principle;
- the principle of proportionality.

Compliance with the above principles should ensure a fair and true view of the financial and economic situation of companies.

As the financial statements are prepared *ex post*, there is a risk of presenting certain postings that are particularly important, for example, to owners or managers. This is most often due to self-interest, not necessarily consistent with the expectations of capital owners, creditors, employees, and other stakeholders (Surdykowska, 2004).

In view of the above, it seems particularly important to respect the principle of going concern. In applying the accounting policies, an entity assumes that it will continue to operate in the foreseeable future to an extent that is not materially less, without going into liquidation or bankruptcy, unless it is inconsistent with the facts or legal situation. In determining the entity's ability to continue as a going concern, the entity's manager shall consider all information available at the date of preparing financial statements regarding the foreseeable future, covering a period of not less than one year from the balance sheet date (Art. 5 of the Accounting Act of 29 September 1994). If the going concern assumption is not reasonable, Article 29(1) of the Accounting Act will apply in the preparation of the financial statements. It results in an obligation to measure the entity's assets at net realizable value, not higher than their acquisition or production costs, less any depreciation or amortization charge that has been made, and

impairment losses (*ibidem*, art. 29).

The principle of going concern in International Accounting Standards is one of the basic principles. Paragraph 25 of IAS 1 provides that, when preparing financial statements, management assesses the entity's ability to continue as a going concern. Financial statements shall be prepared on a going concern basis, except where management either intends to liquidate the entity or to cease trading, or there is no viable alternative to winding up or discontinuing operations. If management is aware of material uncertainties about events or circumstances that may raise serious doubts about the entity's ability to continue operations during the assessment, the entity shall disclose those uncertainties. If an entity does not prepare a financial statement on a going concern basis, it shall disclose that fact, together with the principle on which it was based, when preparing its financial statements, and the reason why the entity's continuing operations are not considered reasonable (International Accounting Standard 1, Presentation of Financial statements).

When assessing whether the going concern assumption is correct, management shall consider any available future information that corresponds to at least twelve months from the end of the reporting period. The scope of the analysis depends on the facts in each case. If the entity has been profitable so far and has easy access to finance, it may conclude that the going concern assumption is reasonable and does not require a detailed analysis. In other cases, management may have to consider several factors that determine the current and expected profitability, repayment schedule, and potential sources of alternative financing to ensure that the going concern assumption is reasonable (*ibidem*, paragraph 26).

It can therefore be concluded that the principle of going concern is a guiding principle alongside the principle of accruals-based accounting. It should also be added that US GAAP (united states general accepted accounting principles) practices are considered as a fundamental principle which underpins the measurement of economic operations and their disclosure in the reports in a manner that is essential for the financial statements' stakeholders (Hořda, 2005).

In 2002, the signing in Norwalk of the "New European Union strategy", the so-called *Norwalk Agreement*, started a global process of harmonizing financial accounting rules. The purpose of the financial statements contained therein is to better compare the data contained in the various documents. It is also a document in which the importance of the going concern approach increased significantly.

It is also worth noting that the entities which are the subject of audit services, the assessment and verification of the going concern principle is being carried out by experts. Responsibility for verifying the assumptions made in accordance with the principle of going concern shall be in accordance with the principles of international auditing standards (ISA). On the basis of ISA 570(5), the auditor gives an opinion on the assumption of going concern, which is formulated at a given time, and relates to the future effects of events or circumstances, which is inevitably uncertain (International Auditing Standard 570). When assessing whether an entity continues to operate,

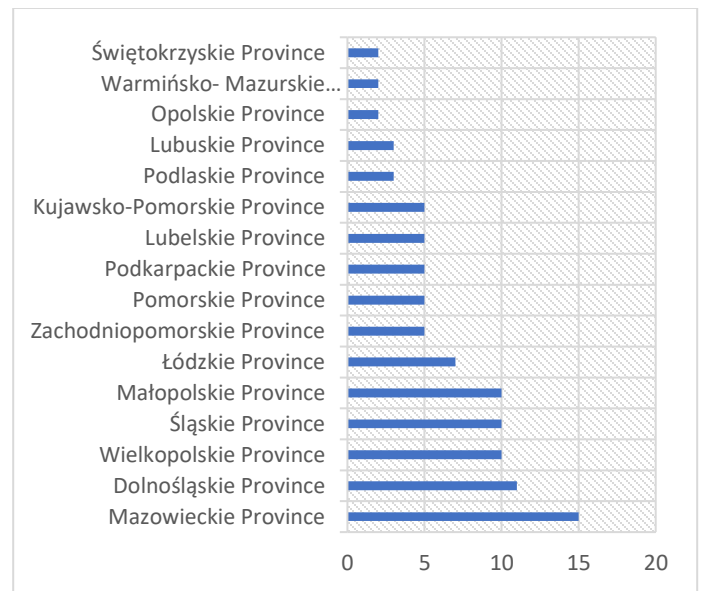
auditors should consider the following factors: type of enterprise, the core business and its size, the operating conditions and the influence of external factors, as well as other factors which, according to the expert, have an impact on the entity’s future operations. The assessment made is a certain degree of probability of an effective assessment. The longer the period for which the assessment is made, the degree of uncertainty is proportionally greater. Therefore, most of these assessments are carried out within 12 months of the balance sheet date.

Consideration of the future of an entity from the balance sheet date for a period of 12 months is a minimum requirement; for example, an entity may not prepare financial statements on a going concern basis if, until the date of approval of the financial statements, a binding decision has been taken to cease operations within 18 months of the balance sheet date (National Accounting Standard 14, paragraph 4.1). Specific rules apply to units with a limited ‘upfront’ contract or activity period status, for which the unit manager assumes, except as described in section 4.6 of the Standard, that the entity will not continue to operate during the last period of the business and during the reporting period immediately preceding it. The above principle assumes that, as expected, the operating period of the entity will not be extended (if possible). When preparing an entity’s financial statements with a limited period of operation on a going concern basis, the manager of the entity shall, in making the necessary judgments and estimates, take into account the limited duration of its operations (ibidem, paragraph 4.2 and 4.6). If, as a result of an analysis by the manager of an entity, it becomes reasonably certain that the entity will not continue to operate in the foreseeable future, the financial statements shall be drawn up on the assumption that the entity will not continue to operate (ibidem, paragraph 4.8).

III. CHARACTERISTICS OF EARLY WARNING MODELS IN THE FOLLOW-UP ASSESSMENT AND DESCRIPTION OF THE TEST SAMPLE

The article used 20 early warning methods which could be used to verify the ability of going concern. The models have been reviewed for predictive efficiency in a sample of 100 companies. 50 companies were selected for the trial, which in the years 2017-2021 declared bankruptcy and 50 healthy counterparts. Companies with good financial standing were selected based on similarities in terms of the business and the similar size of assets and revenues. The sample included companies from all provinces, of which the largest one concern: Mazowieckie, Dolnośląskie, Śląskie, Wielkopolskie and Małopolskie. In contrast, a brief description of the various models is presented in Table 1.

CHART 1 NUMBER OF ENTITIES QUALIFIED FOR THE RESEARCH.



Source: authors development.

TABLE 1. EARLY WARNING MODELS USED FOR THE STUDY

No.	Author / Model Name	Model description
1.	Discriminatory model E. Mączyńska	$Z = 1,5 W_1 + 0,08W_2 + 10,0W_3 + 5,0W_4 + 0,3W_5 + 0,1W_6$ In 1 = (gross profit + depreciation) / liabilities and provisions for liabilities In 2 = assets / liabilities and provisions for liabilities In 3 = Gross profit / assets In 4 = Gross profit / Sales revenue In 5 = Inventory / Total income In 6 = Total income / assets $Z < 0$ firm in difficulty $0 < Z < 1$ weak but not at risk of bankruptcy, $1 \leq Z < 2$ Financial strength, $Z \geq 2$ very good financial standing.
2.	Discrimination model J. Gajdka and D. Mr Stosa	$Z = 0,7732 - 0,0856W_1 + 0,00077W_2 + 0,9221W_3 + 0,6536W_4 - 0,5947W_5$ In 1 = Total income / year-on-year average assets In 2 = (annual average current liabilities * 360) / manufacturing cost In 3 = Net profit / Medium-year assets In 4 = Gross profit / Total income In 5 = liabilities and provisions for liabilities / assets $Z < 0,45$ firm in difficulty $Z > 0,45$ the company poses good financially standing
3.	Discriminatory model D. Hadasik	$Z = 2,60839 - 2,50761 AT_1 + 0,00141147 W_2 - 0,00925162 W_3 + 0,0233545 W_4$ In 1 = liabilities and provisions for liabilities / assets In 2 = (receivables x 365) / Total income In 3 = (stocks x 365) / Total income

No.	Author / Model Name	Model description
		In 4 = Net result / Inventory Z > 0 good financial standing, Of < 0 bankruptcy.
4.	Discriminatory model A. Holdy	$Z = 0,605 + 0,681W_1 - 0,0196W_2 + 0,00969W_3 + 0,000672W_4 + 0,157W_5$ In 1 = current assets / current liabilities In 2 = liabilities and provisions for liabilities / assets * 100 In 3 = Net profit / Annual average assets * 100 In 4 = annual average current liabilities * 360) / costs of products, goods and materials sold In 5 = Total income / year-on-year average assets Z > 0 good financial standing, Of < 0 bankruptcy. -0.3 =< Z =< 0,1 "uncertainty area", no diagnosis
5.	Poznan discriminatory model (M. Hamrola)	$Z = -2,368 + 3,562W_1 + 1,588W_2 + 4,288W_3 + 6,719W_4$ In 1 = Net profit / assets In 2 = (current assets — inventories) / current liabilities In 3 = fixed capital / assets In 4 = Sales profit / Sales revenue and its equivalent Z > 0 good financial standing Of < 0 bankruptcy.
6.	Discriminatory model D. Appenzeller and K. Szarzec	$Z = 0,819W_1 + 2,567W_2 - 0,005W_3 + 0,0006W_4 - 0,0095W_5 - 0,556$ In 1 = Net profit / assets In 2 = (current assets - inventories - short-term prepayments) / current liabilities In 3 = fixed capital / assets In 4 = Sales profit / Sales revenue and its equivalent Z > 0 good financial standing Of < 0 bankruptcy
7.	Discriminatory model B. Prusak	$Z = 1,438W_1 + 0,188W_2 + 5,023W_3 - 1,871$ In 1 = (net profit + depreciation) / liabilities and provisions for liabilities In 2 = operating costs / current liabilities In 3 = Sales profit / assets Z >= -0.295 Financial strength, Of < -0.295 bankruptcy -0.7 =< Z =< 0,2 "uncertainty area", no financial situation diagnosis
8.	The discriminatory model of the Institute of Economic Sciences MR. 'G' E. Mączyńska and M. Zawadzki	$Z = 9,498W_1 + 3,566W_2 + 2,903W_3 + 0,452W_4 - 1,498$ In 1 = EBIT / assets In 2 = equity / assets In 3 = (net profit + depreciation) / liabilities and provisions for liabilities In 4 = current assets / current liabilities Z > 0 good financial standing, Of < 0 bankruptcy
9.	Discriminatory model T. Maślanki	$Z = -0,41052 + 1,59208W_1 + 4,35604W_2 + 5,92212W_3$ In 1 = working capital / assets In 2 = Cash from operating activities [Segment a Cash Flow] / assets In 3 = (operating profit + depreciation) / liabilities and provisions for liabilities Z > 0 good financial standing, Of < 0 bankruptcy
10.	Discriminatory model S. Herman	$Z = 1,293 \times W_1 + 4,169 \times W_2 - 0,432 \times W_3 + 0,696 \times W_4 + 0,322 \times W_5 + 0,342$ In 1 = Gross profit / assets In 2 = Sales profit / Total income In 3 = liabilities and provisions for liabilities / assets In 4 = operating profit / Total income In 5 = equity / liabilities and provisions for liabilities Z > 0 good financial standing, Of < 0 bankruptcy
11.	Discriminatory model A. Waszkowski	In 3 = Sales revenue/liabilities and provisions for liabilities In 2 = Non-current assets / current assets In 3 = Net profit + amortization/depreciation/liabilities and provisions for liabilities In 4 = Sales revenue Total / working capital In 5 = Net profit / Sales Revenue Total $Z = 0,821W_1 + 0,769W_2 + 0,349W_3 - 0,284W_4 + 0,23*8W_5$ Z > 0 good financial standing, Z < 0 Hazard of fall
12.	Discriminatory model M. Potoczna and O. Wiśniewska	$Z = -0,5390W_1 - 0,1581W_2 + 0,0633W_3 - 0,1529W_4$ W1 = Net profit / assets W2 = Operational revenue – operating costs + other operating revenue W3 = long-term liabilities + current liabilities / assets W4 = Net sales in current year – Net sales in previous year Z = 0 firm of good financial standing, Z = 1 firm in bankruptcy.
13.	Logic model D. Wędzki (model 7)	W1= current assets/current liabilities, W2 = liabilities and provisions for liabilities / assets W3 = interest / (profit on economic activity + interest),

No.	Author / Model Name	Model description
		$W4 = [(\text{Net profit}/\text{equity})] / [(\text{Net profit} + \text{interest} \times (1 - \text{compulsory charges on the financial result} / \text{Gross profit})/a]$ $W5 = \text{short-term receivables} \times \text{Number of days in period} / \text{Sales revenue}$ $W6 = \text{Sales profit} / \text{Sales revenue}$ $Z = -4.0 - 6.0W1 + 9.387W2 - 2.088W3 + 1.317W4 + 0.04W5 - 4.217W6$ $Z < 0.5$ good financial standing, $Of > 0.5$ bankruptcies
14	Logic model p. Stępnia and T. Straka	$W1 = \text{the capital of the foreign capital} / \text{assets}$ $W2 = (\text{current assets} - \text{stocks}) / \text{current liabilities}$ $W3 = \text{Net result} / \text{assets}$ $W4 = \text{Sales revenue Total} / \text{operating costs}$ $Z = -19 - 11W1 + 6W2 + 40W3 + 19W4$ Where: $Z > 0$, the audited entity is characterized by a good financial situation $Of < 0$ bankruptcy.
15	Logic model M. Gruszczynski	$W1 = \text{Gross profit} / \text{Net Sales Revenue}$ $W2 = \text{liabilities and provisions for liabilities} / \text{assets}$ $W3 = \text{Inventory} / \text{Net Sales Revenue}$ $Z = 4,3515 + 22.8748W1 - 5,5926W2 - 26.1083W3$ $Z > 0$, the audited entity is characterized by a good financial situation $Z < 0$ firm in difficulty.
16	T Logic model Korola	$W1 = \text{Sales profit} / \text{assets}$ $W2 = \text{Net profit} + \text{amortization/depreciation/liabilities and provisions for liabilities}$ $W3 = \text{operating costs} / \text{current liabilities}$ $Z = 2,0 - 10.19W1 - 4.58W2 - 0.57W3$ $Z < 0,5$ Financial strength, $Of > 0,5$ bankruptcy.
17	Logic model M. Potocznej and O. Wiśniewska	$W1 = \text{operating revenue} - \text{operating costs} + \text{other operating revenue}$ $W2 = \text{Cash}/\text{current liabilities}$ $W3 = \text{Net sales in the current year} - \text{Net sales in the previous year}$ $Z = -0.0001W1 - 0.65W2 - 1.025W3$ $Z = 0$ firm repressed good financial standing, $Z = 1$ firm in bankruptcy.
18	Cracow logistic model	$W1 = \text{Net profit} + \text{amortization}/ \text{long-term liabilities} + \text{current liabilities}$ $W2 = (\text{current assets} - \text{stocks}) / \text{current liabilities}$ $W3 = \text{Gross profit}/\text{current liabilities}$ $W4 = \text{operating profit} + \text{amortization}/\text{depreciation}/\text{assets}$ $Z = 1,8252 - 5.0364W1 - 0.8671W2 + 2.9880W3 - 5.4101W4$ $Z > 0$ Financial good standing, $Z < 0$ Hazard of fall.
19	QUICK TEST	$W1 = \text{equity}/\text{assets}$ $W2 = \text{operating profit}/\text{interest}$ $W3 = \text{Net profit}/\text{average assets}$ $W4 = \text{Total cost}/\text{total revenue}$ Depending on the points raised by the company, it may take one of four places: Financial condition very bad 0-4; Financial situation bad/bad 5-8; Financial context sufficient 9-12; Financial context good 13-16; Financial context very good 17-20.
20	PMORB according to A. Hołdy	$W1 = \text{Sales profit} / \text{Sales revenue for products, goods and materials}$ $W2 = \text{Net profit} / \text{Sales Revenue Total}$ $W3 = \text{Net profit} / \text{average annual equity}$ $W4 = \text{current assets} / \text{current liabilities}$ $W5 = \text{current assets} - \text{stocks} / \text{current liabilities}$ $W6 = \text{short-term investments} / \text{current liabilities}$ $W7 = \text{average stocks} \times 360 / \text{costs of products, goods and materials sold}$ $W8 = \text{average short-term receivables} \times 360 / \text{Revenue from sales of products, goods and materials}$ $W9 = \text{average current liabilities} \times 360 / \text{Sales revenue of products, goods and materials}$ $W10 = \text{liabilities and provisions for liabilities} / \text{assets}$ $W11 = \text{fixed capital} / \text{fixed assets}$ $W12 = \text{Gross profit} + \text{interest payable} / \text{equity installments} + \text{interest payable}$ Modification of model A. The Holdy makes it possible to determine, by means of financial indicators, the location of the company concerned in the industry concerned. Depending on your company's points, it can take up one of four places: Very low space when it gets 12-20 points; a standard place to reach 21-30 points; a good place to reach 31-40 points; a very good place when it gets 41-48 points. The results of the individual indicators refer to the industry value [A. Holda, 2002].

Source: Mączyńska (1994), (Gajdka, Stos 1996), (Hadasik,1998), (Hołda, 2002), (Hamrol, Czajka, Piechocki, 2004), (Appenzeller, K. Szarzec, 2004), (Prusak, 2005), (Mączyńska, Zawadzki, 2006), (Maślanka, 2008), (Herman, 2017)

The study selected 12 discriminatory models, 6 logistic models and 2 scorers, which are applicable to companies in most sectors. This is particularly useful if, as in this case, operators from different areas of activity are included in the sample of companies. In this respect, sectoral models which are

dedicated to enterprises in a particular industry have been omitted. The results from the study are presented later in this chapter.

The purpose of the Article was to assess the effectiveness and applicability of early warning models in examining the

principle of going concern.

IV. USE OF EARLY WARNING MODELS IN THE BUSINESS CONTINUITY STUDY, AS AN EXAMPLE OF A SAMPLE OF COMPANIES

The verification of selected early warning models has been carried out for 5 periods. The last period analyzed was 2021, the time when the COVID-19 pandemic had a significant negative impact on businesses in many sectors. The results of

the test are shown below: The effectiveness of the individual models. The most recent year of the research was the most accurate assessments. The 1606 diagnoses from 2000 were correct. Herman and the Poznań model showed the best results. Another, the most effective models are A. Holdy models and ECI PAN "G". The least valid assessments were obtained in the last period, using model D. Hadasik (74 correct diagnoses). Table 3 shows the effectiveness of early warning models in percentage terms.

TABLE 2. THE EFFECTIVENESS OF EARLY WARNING MODELS IN INDIVIDUAL YEARS

Model	Number of correct model diagnoses per year				
	5*	4	3	2	1
Discriminatory model E. Maczyńska	64	66	68	70	76
Discrimination model J. Gajdka and D. Mr Stosa	62	66	64	68	78
Discriminatory model D. Hadasik	60	62	64	62	74
Discriminatory model A. Holdy	66	66	68	70	86
Poznan discriminatory model (M. Hamrol)	72	70	74	78	92
Discriminatory model D. Appenzeller and K. Szarzec	70	72	74	76	82
Discriminatory model B. Prusak	70	74	72	76	80
The discriminatory model of the Institute of Economic Sciences MR. 'G' E. Mączyńska and M. Zawadzki	74	70	72	74	86
Discriminatory model T. Maślanka	70	72	76	78	80
Discriminatory model S. Herman	76	78	78	80	92
Discriminatory model A. Waszkowski	68	70	70	72	78
Discriminatory model M. Potoczna and O. Wisniewska	72	70	74	76	78
Logic model D. Wędzki (model 7)	72	72	78	78	80
Logic model p. Stepnia and T. Straka	66	68	68	72	74
Logic model M. Gruszczyński	68	68	72	72	78
T Logic model Korola	72	70	74	74	78
Logic model M. Potoczna and O. Wiśniewska	70	70	72	74	78
Cracow logistic model	68	68	70	74	78
QUICK TEST	64	64	66	68	72
PMORB according to A. Holdy	72	74	78	78	86
The total number of valid diagnoses for all models**	1376	1390	1432	1470	1606

*5 - oldest year; 1 - newest year in research. ** – the maximum number of diagnoses per year was 2000 (20 models x 100 units).

Source: authors development.

TABLE 3. EFFECTIVENESS OF EARLY WARNING MODELS PER YEAR (IN %)

Model	Model performance per year				
	5*	4	3	2	1
Discriminatory model E. Maczyńska	64.0%	66.0%	68.0%	70.0%	76.0%
Discrimination model J. Gajdka and D. Mr Stosa	62.0%	66.0%	64.0%	68.0%	78.0%
Discriminatory model D. Hadasik	60.0%	62.0%	64.0%	62.0%	74.0%
Discriminatory model A. Holdy	66.0%	66.0%	68.0%	70.0%	86.0%
Poznan discriminatory model (M. Hamrol)	72.0%	70.0%	74.0%	78.0%	92.0%
Discriminatory model D. Appenzeller and K. Szarzec	70.0%	72.0%	74.0%	76.0%	82.0%
Discriminatory model B. Prusak	70.0%	74.0%	72.0%	76.0%	80.0%
The discriminatory model of the Institute of Economic Sciences MR. 'G' E. Mączyńska and M. Zawadzki	74.0%	70.0%	72.0%	74.0%	86.0%
Discriminatory model T. Maślanka	70.0%	72.0%	76.0%	78.0%	80.0%
Discriminatory model S. Herman	76.0%	78.0%	78.0%	80.0%	92.0%
Discriminatory model A. Waszkowski	68.0%	70.0%	70.0%	72.0%	78.0%
Discriminatory model M. Potoczna and O. Wisniewska	72.0%	70.0%	74.0%	76.0%	78.0%
Logic model D. Wędzki (model 7)	72.0%	72.0%	78.0%	78.0%	80.0%
Logic model p. Stepnia and T. Straka	66.0%	68.0%	68.0%	72.0%	74.0%
Logic model M. Gruszczyński	68.0%	68.0%	72.0%	72.0%	78.0%
T Logic model Korola	72.0%	70.0%	74.0%	74.0%	78.0%
Logic model M. Potoczna and O. Wiśniewska	70.0%	70.0%	72.0%	74.0%	78.0%
Cracow logistic model	68.0%	68.0%	70.0%	74.0%	78.0%
QUICK TEST	64.0%	64.0%	66.0%	68.0%	72.0%
PMORB according to A. Holdy	72.0%	74.0%	78.0%	78.0%	86.0%
Average efficiency of all models	68.8%	69.5%	71.6%	73.5%	80.3%

*5 - oldest year; 1 - newest year in research.

Source: authors development.

The effectiveness of all discriminatory models is increasing systematically from year to year. The older the years analyzed, the less effective all models are. The average effectiveness of all models ranged from 68,8% (oldest year of study) to 80,3% (youngest year of study). The most predictive models were S. Herman, Poznan model, A. Hołdy, ECI MR. 'G' and PMORB according to A. Hołdy. The efficiency of these models has been above 80% of the efficiency in the last year of the research. Quick-Test, P. Stepnia, T. Straka and D. Hadasik are the least predictive models. However, it is worth to add that their effectiveness was above 70%. The presented results allow us to draw the conclusion that most early warning models have the best credibility at the time of their creation and in the early years of their existence. Older models have a lower efficiency, which further confirms that the same level of effectiveness of discriminatory models cannot be said at the time of their creation or subsequent use. It can also be concluded from the results that the older the year in the research, the reliability of the models was lower. A proportional relationship can be observed – as the analysis approaches the current period, the forecast credibility is increasing – in all models. It is also worth highlighting that the latest year of research, 2021, has produced the most correct diagnoses, despite the many perturbations associated with the COVID-19 pandemic. The difficult and often unprecedented conditions for doing business did not translate into inadequate diagnosis of early warning models. It can therefore be concluded that they are sufficiently effective to assess the going concern of companies.

V. CONCLUSION

In making a synthetic assessment of the early warning models that have been verified, most of them have a high level of effectiveness. All models have reached at least 60% of the forecast efficiency. In the last year analyzed, the average accuracy of forecasts was 80,3%. The two most effective models have been effective in the forecasts for the last year, respectively, after 92% of the relevant forecasts. When assessing the models for their effectiveness in relation to the period in which they were created. In general, the longer the model period to use, the less effective the model will be.

The use of early warning models in assessing the going concern seems to be a good tool. In addition to the traditional indicative analysis, early warning models clearly allow an assessment of the current situation and a forecast of the situation in the nearest future. It cannot therefore be surprising that this type of model is popular. They are both simple to calculate and provide reliable diagnosis. What is clear advantage of them, especially with regard to tools that require expertise in their use and subsequent interpretation of results, and the possession of specialized software.

VI. REFERENCES

Appenzeller D., Szarzec K. (2004). Prognozowanie zagrożenia upadłością polskich spółek publicznych. Rynek Terminowy. 1, pp. 120-128.

Gajdka J. i Stos D. (1996). Wykorzystanie analizy dyskryminacyjnej w ocenie kondycji finansowej przedsiębiorstw [in:] Restrukturyzacja w procesie przekształceń i rozwoju przedsiębiorstw, AE in Cracow.

Hadasik D. (1998). Upadłość przedsiębiorstw w Polsce i metody jej prognozowania. Zeszyty Naukowe Akademii Ekonomicznej w Poznaniu, Seria II, Prace habilitacyjne. 153, pp. 198-204.

Hamrol M., Chodakowski J. (2008). Prognozowanie zagrożenia finansowego przedsiębiorstwa. Wartość predykcyjna polskich modeli analizy dyskryminacyjnej. Badania Operacyjne i Decyzje. 18 (3), pp. 17-32.

Hamrol M., Czajka B., Piechocki M. (2004). Upadłość przedsiębiorstwa – model analizy dyskryminacyjnej. Przegląd Organizacji. 6 (773), pp. 35-39, <https://doi.org/10.33141/po.2004.06.09>.

Herman S. (2017). Specyfika branżowa spółek akcyjnych w Polsce a prognozowanie ich upadłości. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie. 11 (971), pp. 41-50, doi: 10.15678/ZNUEK.2017.0971.1103.

Hołda A. (2002). Ustalanie sytuacji finansowej jednostki z wykorzystaniem mierników syntetycznych – koncepcja wartości średnich. Monitor Rachunkowości i Finansów. 1 (36).

Maślanka T. (2008). Przepływy pieniężne w zarządzaniu finansami przedsiębiorstw. Warsaw. C.H. Beck.

Mączyńska E. (1994). Ocena kondycji przedsiębiorstwa. (Uprozczone metody). Życie Gospodarcze. 38, pp. 45-45.

Mączyńska E., Zawadzki M. (2006). Dyskryminacyjne modele predykcji upadłości przedsiębiorstw. Ekonomista. 2, pp. 205-235.

Prusak B. (2005) Nowoczesne metody prognozowania zagrożenia finansowego przedsiębiorstw. Warsaw, Centrum Doradztwa i Informacji Difin.

Ustawa o rachunkowości z dnia 29 września 1994 (Dz.U. z 2016 r., poz. 1047 z późn. Zm.).

Surdykowska S. (2004). Rola Internetu w eliminowaniu asymetrii informacyjnej na rynkach kapitałowych [in:] Grzywak A. (ed.), Internet w społeczeństwie informacyjnym. Internet w systemach zarządzania. Warsaw. WNT.

Międzynarodowy Standard Rachunkowości nr 1 *Prezentacja sprawozdań finansowych*, przyjmujące określone międzynarodowe standardy rachunkowości, zgodnie z Rozporządzeniem Komisji (UE) 2022/357 z dnia 2 marca 2022 r. zmieniające rozporządzenie (WE) nr 1126/2008 przyjmujące określone międzynarodowe standardy rachunkowości zgodnie z rozporządzeniem (WE) nr 1606/2002 Parlamentu Europejskiego i Rady w odniesieniu do Międzynarodowych Standardów Rachunkowości 1 i 8.

Hołda A. (2005), Zasada kontynuacji działalności w kontekście problematyki błędów i oszustw. Materiały konferencyjne Rachunkowość kreatywna a oszustwa księgowo WSB w Dąbrowie Górniczej.

Międzynarodowy Standard Rewizji Finansowej Nr 570 *Kontynuacja działalności*, uchwalony przez International Auditing and Assurance Standards Board (IAASB), opublikowany przez International Federation of Accountants (IFAC) w grudniu 2016 roku w języku angielskim, został przetłumaczony na język polski przez Polską Izbę Biegłych Rewidentów (PIBR) w lutym 2018 roku, i jest powielany za pozwoleniem IFAC. Tytuł oryginału: International Standard on Auditing (ISA) 570 (Revised) *Going Concern*, opublikowany w: Handbook of International Quality Control, Auditing, Review, Other Assurance, and Related Services Pronouncements 2016-2017 Edition, Volume I, ISBN: 978-1-60815-318-3.

Krajowy Standard Rachunkowości Nr 14 *Kontynuacja działalności oraz rachunkowość jednostek przy braku kontynuowania działalności* (Dz. Urz. Ministra Finansów, Funduszy i Polityki Regionalnej z 10 sierpnia 2021 r., poz. 1019).

<https://www.coig.com.pl/raporty-2022.php>, access: 6 July 2023.

https://www.allianz-trade.com/content/dam/onemarketing/aztrade/allianz_trade_com/pl_PL/dokumenty/centrum-prasowe/wiadomosci/2023-04-13-allianz-trade-niewyplacalnosci.pdf, access:15 July 2023.

<https://www.bankier.pl/wiadomosc/Ryzyko-upadlosci-w-gospodarce-znacaco-rosnie-przybedzie-niewyplacalnych-firm-8564015.html>, access: 28 July 2023.