STRATEGIC MANAGEMENT, Vol. 28 (2023), No. 2, pp. 021-044

DOI: 10.5937/StraMan2200035G

Received: June 01, 2022
Revised: September 29, 2022
October 29, 2022
Accepted: December 12, 2022
Published online: March 14, 2023

Bibliometric analysis of the literature on evaluation models of the bankruptcy risk

Veronica Grosu
Stefan cel Mare University, Faculty of Economics, Administration and Business, Department of Accounting, Audit and Finance, Suceava, Romania
https://orcid.org/0000-0003-2465-4722

Ancuța Anisia Chelba
Stefan cel Mare University, Faculty of Economics, Administration and Business, Department of Accounting, Audit and Finance, Suceava, Romania
https://orcid.org/0000-0001-9676-6833

Anatol Melega
Stefan cel Mare University, Faculty of Economics, Administration and Business, Department of Accounting, Audit and Finance, Suceava, Romania
https://orcid.org/0000-0003-4763-0520

Daniel Botez
Vasile Alecsandri University, Faculty of Economics Science, Department of Accounting, Auditing and Economic-Financial Analysis, Bacau, Romania
https://orcid.org/0000-0003-0986-7631

Mihaela Ionela Socoliuc
Stefan cel Mare University, Faculty of Economics, Administration and Business, Department of Accounting, Audit and Finance, Suceava, Romania
https://orcid.org/0000-0002-7250-2304

Abstract

Background: To manage an enterprise effectively, it is necessary to analyze and diagnose its financial condition, an activity that can warn management of dangerous business situations. Topics such as assessing financial position, performance, and risk, especially after situations that involve an economic and financial crisis in the company have been widely discussed in scientific literature.

Purpose: The purpose of the research is to highlight the main research trends regarding bankruptcy risk assessment models.

Study design/methodology/approach: The research strategy is based on two main directions: the first involves the selection of research papers with topics on Conan & Holder and Taffler models published on WoS between 2007 and 2021 and those published on SCOPUS between 2006 and 2021. The second direction aims to select the relevant papers and perform a content analysis of financial-accounting information of Conan & Holder and Taffler models.

Findings/conclusions: The results obtained were concretized in the design of a bibliometric analysis of bankruptcy risk assessment models, which provides an overview of the new research trends regarding bankruptcy risk assessment models. Thus, it was found that most of the studies focus on the analysis of the efficiency of the bankruptcy risk assessment methods and the identification of new options that allow predictability of the risk.

Limitations/future research: Our study limitations are mainly due to the bibliometric algorithm, in the sense that only papers indexed in WoS and Scopus can be imported, processed, and interpreted, which excludes parts of the existing literature on this topic and omits the analysis of some pertinent contributions to our research area. This research can be used as a cornerstone for new research directions, both quantitative and qualitative, on the mechanism of application of bankruptcy risk prevention methods.

Keywords
companies in crisis; models of the bankruptcy risk; bibliometric analysis;

Introduction

Any business can face at some point a crisis that can jeopardize its functioning and image. The crisis situation is characterized by an increased risk of bankruptcy, a weak competitive position, financial instability. Thus, crises are characterized by pronounced instability, so they are accompanied by increasing volatility and uncertainty. The crisis can also be defined as a period in the development of a system / company characterized by the accentuated accumulation of difficulties and the conflicting eruption of tensions, which makes its normal functioning impossible and triggers strong pressures for change. The possible occurrence of bankruptcy is a state of crisis of the company.

In order to manage the enterprise effectively, it is necessary to analyze and diagnose the financial condition of the enterprise, a kind of "alert" that warns the management of dangerous business situations. Topics have been widely debated in the literature such as assessing financial position, performance, risk, especially after the onset of a situation involving the economic and financial crisis of the company which results in low profitability, restriction of activity or even the onset of bankruptcy. Particular attention should be paid to the risk of bankruptcy and the models used to identify this type of risk successfully. There are a number of methods that aim to detect vulnerabilities and the risk of bankruptcy by determining a score function whose value categorizes vulnerable and healthy entities. The calculation of a score function is based on financial-accounting rates. There are several bankruptcy risk assessment scoring models, among which we mention only a few: Conan & Holder model, Taffler model, Springate model, Ohlson model, etc. In this paper, we have chosen to analyze the Conan & Holder model and the Taffler model because they belong to renowned schools, namely: the Conan & Holder model belongs to the European continental school and the Taffler model to the Asian continental school.

The purpose of this article is to review quality bibliographic sources that have addressed the topic of bankruptcy risk. The main objectives are focused on the selection of those publications published on the Web of Science (WoS) and SCOPUS and which aimed to address the risks of bankruptcy, and subsequently on the bibliometric analysis of these studies. The results obtained are concretized in the design of a research agenda with the topic of bankruptcy risk, in which are presented the most relevant models for assessing the risk of bankruptcy, the limits, but also the solutions offered by using these models in certain crisis situations. to avoid obtaining results that do not reflect the economic reality at the time of the bankruptcy. The results obtained in this paper can be a starting point for any researcher concerned with the issue of bankruptcy risk assessment and the most relevant models of bankruptcy risk assessment currently used internationally.

1. Literature review

Crisis is a term often used for difficult, dangerous and future situations and refers to an extremely wide range of natural, social, economic and mental processes (e.g. political crisis, economic crisis, financial crisis, oil crisis, environmental crisis, moral crisis, art crisis, crisis of values, health crisis, age crisis, etc.) (Dubrovski, 2004) An older definition of the crisis, mentioned by Krystek (1987), argues that the company's crisis is "an unwanted and unplanned process of limited duration and susceptibility, with an ambivalent way out, ending by failing to achieve its dominant goals. At the same time, the crisis could lead to the collapse of a company." Financial difficulties are one of the most important threats that companies face, regardless of their size and operations (Charitou, Neophytou & Charalambous, 2004).

The crisis, at the state level, is defined as the phenomenon that occurs when the phenomena of adverse selection and moral hazard are cumulated to a level where the markets no longer direct the available funds to the economic agents that represent the best investment options (Aglietta, 2008). On the other hand, the crisis at the enterprise level may be caused by the mismatch of its financial and economic parameters with the parameters of the environment. In the event of a crisis at the enterprise level, the company will face an acute shortage of financial resources, which prevents the normal development of the field of activity, timely payment of taxes, salaries and other obligations (Klodāne, Mietule & Beinaroviča-Litvinova, 2017). The crisis within a company can occur at any stage of the life cycle of that company. Crises at the enterprise level have several features in common, namely: they are a critical moment; it is triggered suddenly, by the rapid and brutal change of a state; manifests itself through difficulties; it represents a dangerous moment, a serious situation, which induces a period of tension (Blanculescu, 2006).

In general, the crisis in a company is considered a negative phenomenon (Valackienė & Virbickaitė, 2011). The crisis situation is an unstable state of the company, when the usual business operations fail and the results of the company's performance decrease. However, there are authors who consider that a crisis, although dangerous for the life cycle of the organization, still offers the company the opportunity to become stronger (Ulmer, Sellnow & Seeger, 2007). The signs of a crisis within a firm are usually: "declining liquidity and profitability, loss of financial stability, rising costs, loss of market and competitive capacity" (Blume, Kieser & Holscher, 1998; Cantor & Packer, 1994; Dwyer & Stein, 2006; Gupton, 2005; Forster, Ward & Woodroof, 1998). If a company cannot or does not want to notice the signals of an early crisis and predict the risks that may threaten the company, then the legal tools must be applied: reorganization processes and bankruptcy. For companies that reach this stage, reorganization is often the only way to avoid bankruptcy and maintain business development. In the event of bankruptcy, there is a big chance that the company will cease to exist (Cho, Okafor, Ujah & Zhang, 2021).

"Bankruptcy is a critical issue for companies because of its negative social and financial consequences" (Wu, 2010). Bankruptcy is an indissoluble phenomenon related to the modern market economy. Also, the large number of bankruptcies reported by companies can lead to negative consequences at the local level - for economic development and economic circumstances in the region and - on a national scale - for the economy of the whole country (Pisula, 2020). According to Pasternak-Malicka, Ostrowska-Dankiewicz and Dankiewicz (2021), "economic activity is often accompanied by risk-related uncertainty, which is difficult to recognize. Underestimating or not recognizing such a crisis situation in the organization, or adopting an inadequate action strategy can lead to a serious crisis, which can become a premise and basis for economic bankruptcy." No matter how the bankruptcy is defined, a business does not collapse overnight. Bankruptcy is usually preceded by a crisis that may or may not lead to insolvency. Only the inaction or mistakes made during the crisis in the company contribute to its bankruptcy. It should be noted that "the emergence of a financial crisis can also contribute to bankruptcy. Moreover, such disturbances not only affect small and medium-sized enterprises, but can also contribute to the problems of institutions whose task is to stabilize the market, such as insurance companies" (Dankiewicz & Simionescu, 2020; Tsvetkova, Bugaev, Belousova & Zhukova, 2021; Meekaewkunchorn , Szczepańska-Woszczyna, Muangmee, Kassakorn & Khalid, 2021). Firms show symptoms of imminent crisis long before bankruptcy occurs. It is assumed that "the symptoms of imminent bankruptcy are visible in the analysis of indices already in the period from one to four years preceding the court ruling on the insolvency of the debtor" (Antonowicz, 2015). The bankruptcy crisis of a company affects people both inside and outside. Typically, the main stakeholders affected by a company's bankruptcy crisis are divided into the following ten groups: owners, manager, creditors, investors, employees, customers, suppliers, the state, auditors and professional accountants (Chelba & Grosu, 2021).

Right and constructive decisions contribute to the success of an entity, while wrong decisions can lead to a deterioration of the company's financial situation and even lead to its bankruptcy (Boratyńska, 2021). Detecting the company's crisis and eliminating its negative effects, as well as its causes, is in the first phase a task of the company's management, shareholders and owners (Arieshanti, Purwananto, Ramadhani, Nuha & Ulinnuha, 2013). They are the first of all stakeholders to receive evidence that suggests a possible crisis. Based on their competence and relevant decision-making models, management, shareholders and owners must initiate appropriate measures to eliminate the crisis (Cvilikas, Kurschus & Šarapovas, 2015). According to Nguyen & Kien (2022), "the risk of bankruptcy due to objective factors stems from changes in financial markets, such as interest rates, exchange rates and commodity prices. The risk of bankruptcy caused by subjective factors derives from the financial decisions of the managers". In general, the risk is the measurable uncertainty of events that occur randomly in the future and cause damage. The risk of bankruptcy shows the possibility that a company will not be able to meet its debt obligations, that is, the probability that a company will go bankrupt in the next few years. Bankruptcy risk assessment is especially important for investors in making investment decisions in stocks or bonds, but also for managers in making financial decisions regarding financing, investment and distribution policy" (Bărbuță-Mișu & Madaleno, 2020). Investors and creditors are interested in predicting the bankruptcy of companies due to the possibility

of their own losses (Inam, Inam, Mian, Sheikh & Awan, 2019). Bankruptcy risk assessment models are also important tools for bankers, rating agencies and even firms in difficulty (Altman, Iwanicz-Drozdowska, Laitinen & Suvas, 2017).

The models we chose for the analysis, namely the Conan & Holder model and the Taffler model, use the scoring method in assessing the risk of bankruptcy. The scoring method is a "method of internal and external diagnosis, which aims to measure the risk of investors, creditors and the economic agent himself in his future activity. This method occupies an important position in financial analysis and is based on discriminatory analysis" (Bordeianu, Radu, Paraschivescu & Păvaloaia, 2011). Following discriminant analysis, scoring is a linear function of a set of reports or significant financial variables. Discriminant analysis is used to develop models for classifying/predicting the relevance of observations to certain a priori determined classes. Investors and creditors are interested in predicting the bankruptcy of companies due to the possibility of their own losses (Inam, Inam, Mian, Sheikh & Awan, 2019). To this end, a classifier is constructed in the discriminant analysis based on a set of observations and some characteristic indicators for these observations (Armeanu, Vintilă, Moscalu, Filipescu & Lazăr, 2012). The advantages of discriminatory analysis are "unambiguous interpretation and high accuracy of the results of estimating the risk of bankruptcy of the enterprise, which also take into account industrial specialization and timing in internal models" (Neskorodieva, Megits, Rodchenko, Pustovhar & Stamatin, 2019).

The Conan-Holder model was developed in 1978 with the immediate aim of analyzing the degradation of small and medium enterprises in France and is based on the liquidity-demand analysis (Miţul & Odainîi, 2018). This is an international model that is part of the continental European school of bankruptcy risk assessment models. The model developed by the two authors falls within the statistically tested methods. The researchers established a sample of small and medium enterprises, which they studied through the financial–accounting variables. The Conan & Holder model applies to industrial companies with between 10 and 500 employees. It is based on a sample of 95 small and medium-sized enterprises, half of which went bankrupt between 1970 and 1975. The analyzed companies were statistically grouped to determine a score function applicable to industrial companies, construction companies, wholesale and transport companies (Bărbuţă-Mişu & Codreanu, 2014). The Taffler model was designed in 1983 by English scientists R. Taffler and G. Tishou who proposed the Z model based on the calculation of four factors. According to Taffler (1983), the first step in building this model was "to calculate over 80 carefully selected reports from the accounts of all listed industrial firms that failed between 1968 and 1976 and 46 randomly selected solvent industrial firms." Then, using, among other things, linear discriminant analysis in stages, the z-score model was derived by determining the best set of reports that, taken together and properly weighted, made the optimal distinction between the two samples (Agarwal & Taffler, 2007).
Score models (Conan, Holder & Taffler) produce a value (z score) that is used to estimate the risk of bankruptcy and solvency of a business. Each model focuses on different financial statements and various fields of interpretation for the Z score (Vîrcolici, 2019). Assessing the likelihood of an entity's insolvency is a daunting task. Each model may reveal a different area of issue and for these reasons it is recommended that both models be applied together to get a more complete picture of the risks that threaten the company. It is important to note that one cannot talk about the existence of a risk of bankruptcy of a business in the absence of a financial-accounting diagnosis that would determine the state of insolvency, recognized as that state of the patrimony of an entity characterized by insufficient funds to pay certain determined, liquid and due debts (Voda, Dobrotă, Ţîrcă, Dumitraşcu & Dobrotă, 2021).

The previously revised literature is the premise for formulating the following research questions:

RQ 1: What are the new research trends on bankruptcy risk assessment models, the Conan & Holder model and the Taffler model, based on the WOS indexed papers in the last 5 years (2007-2021)?

RQ 2: What are the new research trends on the Conan & Holder model and the Taffler model bankruptcy risk assessment models, based on the SCOPUS indexed papers in the period 2006-2021?

RQ 3: Is there international collaboration between authors, countries and institutions on the analyzed topic in order to establish the need for perfection of the evaluation models Conan & Holder model and Taffler model?

The global statistical situation on the number of bankruptcies is currently growing rapidly (Grosu & Chelba, 2020). Under these conditions, economic entities become more aware of the importance of

early bankruptcy prediction and attach particular importance to the use of general models for assessing the probability of bankruptcy, models based on well-founded principles, techniques and methodologies (Kliestik et al., 2018).

2. Research methodology

Based on the purpose and the questions of our paper, the research methodology can be structured into 4 steps: choosing the databases for analysis; setting the time frame for the research; choosing the software for analysis and data analysis (see Figure 1).

The research methodology was designed based on previous research using the Text Mining approach to identify research trends, as well as the relationships between the analyased topics (Cicea et al., 2019; Cicea et al., 2021).

The bibliometric analysis of the literature allows the management of all existing studies, thus resulting in a very complex and extensive research (Melega, 2022; Grosu et al. 2022).

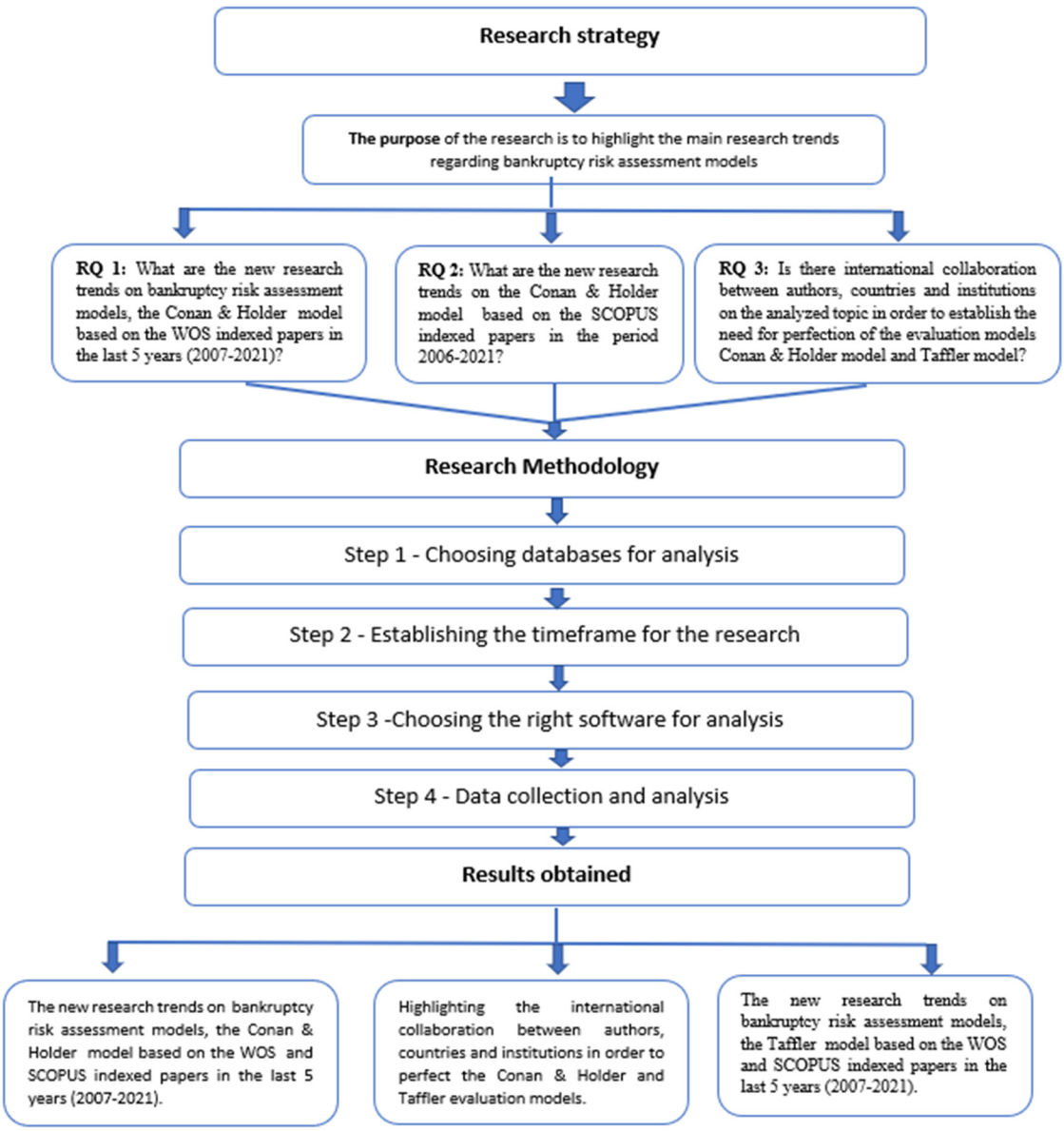

Figure 1 Research strategy
Source: Developed by the authors

Choosing the databases for analysis

For our work, we considered it appropriate to select the WoS and SCOPUS platforms as databases. We made this choice because these databases are the most relevant tools in bibliometric research. According to Echchakoui (2020) "WoS has traditionally been the largest and most exclusively accessible database for bibliometric analysis, but since its introduction by Elsevier and its ease of accessibility in universities around the world, SCOPUS has become a major competitor to WoS for conducting such analyses." Sanchez et al. (2017) argue that in terms of conducting bibliometric analyses, when comparing WoS and SCOPUS there is no superiority of one database over the other. However, some authors found in their research that of all the reviewed databases, WoS would be the most selective and that approximately 99.11% of the journals indexed in WoS are also indexed in Scopus (Singh et al., 2021). It was also found that the results of bibliometric analyses can vary depending on the used database (Mongeon & Paul-Hus, 2016). Therefore, we believe that both WoS and SCOPUS are important databases, which, taken together, are an important tool in bibliometrics, complementing each other.

Setting the time frame for research

Regarding the choice of the time frame for the research, when the scientific papers were searched in the databases, no selection criteria for the time frame were imposed, in the sense that we considered it appropriate to select all the scientific output published on WoS and SCOPUS in order to avoid any suspicion of subjective selection of some papers. We consider that the selection of the entire scientific production brings real advantages, because the results of the analysis are based entirely on objective and officially reported data that is recognized by the scientific community. We also chose this option because as a rule, in bibliometric network analysis, researchers frequently use mapping and clustering techniques in a combined way. However, we have to keep in mind that the mapping and clustering techniques that are used together are based on very different ideas and assumptions (Waltman, Van Eck & Noyon, 2010); therefore, in the present research the selection of the entire published scientific output seemed more appropriate. At the time of the research, we noticed that scientific production is limited over certain periods of time, in the sense that when searching for Conan and Holder Model keywords on the WoS database, research results were found only for the period 2009-2020 and for the same keywords but on the SCOPUS database, research results were found only for the period 2010-2017. Also, when searching for Taffler Model keywords on the WoS database, research results were found only for the period 2007-2009 and for the same keywords but on the SCOPUS database, research results were found only for the period 2006-2021. Under these circumstances, the research questions were adapted according to the production period found for each keyword combination and for each database. Although scientific output has been limited to these time periods, it is important and essential to state that these time periods are current and capture new global economic conditions in the present context of research on bankruptcy risk assessment methods and techniques.

Choosing the software for analysis

In order to perform the bibliometric analysis of the selected papers, the clustering method was applied with the help of the VOSviewer software, where only the data that was provided according to the initially selected research areas, publication years, publication sources, citation index and regions of affiliation were processed, resulting in the following items: frequency of occurrence of key concepts, number of clusters, links and total links strength.

The VOSviewer software is a common tool in bibliometric analyses, used by many researchers, due to the fact that this software maps the data (Al Husaeni & Nandiyanto, 2022), providing this way a map of the main research topics, highlighting also their interconnectivity and the main research trends. According to Borner et al. (2005), VOSviewer software is a "visualization technique that can be used to map the growing domain structure of scientific disciplines and to support information retrieval and classification." Compared to other bibliometric software, VOSviewer offers the possibility to examine in detail the mapping of articles by topic, author, country or institution, highlighting in particular the similarities between data and the interconnectivity between them, grouping them into clusters. The VOSviewer software provides two types of maps: distance-based maps, which "reflect the strength of the relationship between elements, facilitating the identification of groups of related elements" and graph-based maps, which "draw lines between elements to indicate relationships" (van Eck &

Waltman, 2010). Thus, the reason for opting for a bibliometric analysis is that it allows the management of hundreds or even thousands of articles, as well as other indicators specific to quality research, resulting in a very complex and extensive research.

Selecting the results

In order to process the information we need in the bibliometric analysis, as well as in order to obtain the most accurate analysis, in the first stage of selecting the results we established a series of criteria, as follows:

a) inclusion - only papers with the topic Bankruptcy Risk Assessment Models, Bankruptcy Risk Analysis Models, Conan and Holder Model, Conan and Holder Model Z Score, Taffler Model and Taffler Z Score Model, including only the following areas of research: Economics, Business Finance, Management, Business, Statistical Probability (WoS); Business, Management, Accounting; Economics, Econometrics and Finance (SCOPUS); such as all years of publication, all geographical regions and all types of articles (articles, research paper, proceedings paper, early access, review articles, book, book chapters, data papers, news items, conference paper, review, conference review), and regarding the search on SCOPUS the established topic was selected to be searched only in the title of the works, in the abstract and in the keywords;

b) exclusion - the research areas that are not found in the ones mentioned above were eliminated and also, editorial materials, meeting abstracts, notes and erratum published with the mentioned topics were not taken into account.

Table 1 Centralization of WoS and SCOPUS research results

Key concepts sought on WoS	Research results	Key concepts sought on SCOPUS	Research results	Total
Evaluation models of the bankruptcy risk	92	Evaluation models of the bankruptcy risk	39	131
Analysis models of the bankruptcy risk	540	Analysis models of the bankruptcy risk	294	834
Conan and Holder Model	6	Conan and Holder Model	6	12
Conan and Holder Z Score Model	3	Conan and Holder Z Score Model	1	4
Taffler Model	16	Taffler Model	11	27
Taffler Z score Model	9	Taffler Z score Model	3	12
Total	666	Total	354	1,020

Source: Developed by the authors

In table 1 it can be seen that the selection of works from the two databases (WoS and SCOPUS) resulted in a total of 1,020 works. This database was created taking into account the above set of criteria. With the help of this database, we have developed bibliometric indicators of quantity, quality and structure in order to evaluate the scientific activity of this field. When looking for key concepts - assessment models, bankruptcy risk analysis - the most productive combination of keywords was “models of bankruptcy risk analysis” (Analysis models of the bankruptcy risk) which resulted in a total of 834 papers. The fewest results resulted in the search for keywords for the Conan-Holder model (a total of 12 papers for Conan and Holder Model and a total of 6 papers for Conan and Holder Z Score Model). Searching for Taffler Keywords found more papers than Conan-Holder (a total of 27 papers for Taffler Model and a total of 12 papers for Taffler Z score Model).

In general, a higher number of WoS results (666 scientific papers) can be seen compared to the results provided by SCOPUS (354 scientific papers).

3. Results and discussions

In table 1 it can be seen that the selection of works from the two databases (WoS and SCOPUS) resulted in a total of 1,020 works. This database was created taking into account the above set of criteria. With the help of this database, we have developed bibliometric indicators of quantity, quality and structure in order to evaluate the scientific activity of this field. When looking for key concepts - assessment models, bankruptcy risk analysis - the most productive combination of

keywords was "models of bankruptcy risk analysis" (Analysis models of the bankruptcy risk) which resulted in a total of 834 papers. The fewest results resulted in the search for keywords for the Conan-Holder model (a total of 12 papers for Conan and Holder Model and a total of 6 papers for Conan and Holder Z Score Model). Searching for Taffler Keywords found more papers than Conan-Holder (a total of 27 papers for Taffler Model and a total of 12 papers for Taffler Z score Model). In general, a higher number of WoS results (666 scientific papers) can be seen compared to the results provided by SCOPUS (354 scientific papers).

3.1. Bibliometric analysis of the Conan & Holder model

The Conan & Holder model is an internationally recognized model, which was founded in 1978, and which belongs to the continental European school. Thus, in this section, we aim to answer the following questions:

RQ 1: What are the new research trends on bankruptcy risk assessment models, the Conan & Holder model, based on the WOS indexed papers in the last 5 years (2007-2021)?

RQ 2: What are the new research trends on the Conan & Holder model based on the SCOPUS indexed papers in the period 2006-2021?

We have presented in Table 2 the top 9 of the publication sources, organizations, authors, countries involved and of the years according to the number of works published for the Conan-Holder model. Since the search for this topic - Conan and Holder Model - resulted in 6 scientific papers for both WoS and SCOPUS (12 scientific papers in total), this table shows all the papers that resulted from the search.

We note that between the data provided by the two platforms WoS and SCOPUS, there are many similarities such as the top 10 of the publishing sources, where the 1st place is occupied by Economic Computation and Economic Cybernetics Studies and Research, as well as the organizations involved where on the first place is the "Lower Danube" University of Galați with 3 papers for both databases. Also, in the case of the authors Bărbuță-Mișu, N. is on the first place for both WoS and SCOPUS, and Romania ranks first in the top of the most productive countries also for both scientific search engines. In fact, as can be seen, all the works were written by Romanian authors, except for one work where there was a collaboration between a Romanian and a Portuguese author, for this reason in the case of WoS, Portugal appears in the 2nd place with a single work. The authors are more numerous than the existing works because in some works there were two or three authors, the same situation being in the case of the organizations involved, they indicate the university where each author is affiliated. The differences can be seen in terms of the most productive years of publication, where we note that 2010 is in the top WoS, and in the case of SCOPUS, 2011 records the most publications on the Conan and Holder Model.

Table 2 Top 9 most productive publishing sources, organizations, authors, countries, and years of publishing on WoS and SCOPUS related to the Conan and Holder Model

	Top	Publication source	NA	Organizations involved	NA	Authors	NA	Countries	NA	PY	NA
WoS	1	Economic Computation and Economic Cybernetics Studies and Research	1	University of the Lower Danube Galați	3	Bărbuță-Mișu, N.	3	Romania	6	2010	2
	2	Innovation Management and Sustainable Economic Competitive Advantage from Regional Development to Global Growth VOLS I VI 2015	1	University of Agronomic Sciences Veterinary Medicine Bucharest	1	Afanase, C.	1	Portugal	1	2015	2
	3	4th World Conference on Business Economics and Management WCBEM 2015	1	Petru Maior University, Târgu Mureș	1	Cibotariu, I.S.	1	-	-	2009	1
	4	Applied Economics Business and Development	1	Ștefan Cel Mare University of Suceava	1	Kicsi, R.	1	-	-	2020	1

	5	Management in the Worldwide Contemporary Challenges	1	University of Aveiro, Portugal	1	Madaleno, M.	1	-	-	-	-
	6	Journal of Risk and Financial Management	1	University of Economic Studies Bucharest	1	Mazilescu, V.	1	-	-	-	-
						Popescu, A.	1	-	-	-	-
						Spatacean, I.O.	1	-	-	-	-
						Stroe, R.	1	-	-	-	-
SCOPUS	1	Economic Computation And Economic Cybernetics Studies And Research	1	University of the Lower Danube Galați	3	Bărbuță-Mișu, N.	3	Romania	6	2011	2
	2	Quality Access To Success	1	Bucharest Academy of Economic Studies	1	Aldea, D.	1	-	-	2017	1
	3	Risk Governance And Control Financial Markets And Institutions	1	University of Agronomic Sciences and Veterinary Medicine in Bucharest	1	Cioban, G.L.	1	-	-	2016	1
	4	Undertanding Bankruptcy: Global Issues, Perspectives and Challenges	1	Ștefan cel Mare University of Suceava	1	Iancu, E.	1	-	-	2015	1
	5	27th International Business Information Management Association Conference - Innovation Management and Education Excellence Vision 2020: From Regional Development Sustainability to Global Economic Growth, IBIMA 2016	1	University of Economic Studies Bucharest	1	Lădaru, R.	1	-	-	2010	1
	6	26th International Business Information Management Association Conference - Innovation Management and Sustainable Economic Competitive Advantage: From Regional Development to Global Growth, IBIMA 2015	1	-	-	Mazilescu, V.	1	-	-	-	-

* NA – number of published articles; * PY – year of publication.
Source: the authors' own development using WoS and SCOPUS databases

Based on the search protocol applied on the WoS platform mentioned in Figure 1, a number of 6 papers for the selected period resulted, these being imported into the VOSviewer software which selected 34 terms of which only 27 are connected to each other and in the same time they have reached the threshold of at least one frequency.

The frequency network of keywords or terms on the Conan and Holder Model (Figure 2) suggests that this concept is closely related to the concept of bankruptcy risk (where it records a

frequency of 3 according to VOSviewer), bankruptcy risk (frequency of 2) and prediction (frequency 2), and the rest of the concepts have a lower frequency, of one (see Table 3). From Figure 1 (a) we see that the network groups the 27 terms into four clusters according to their relevance. The first group comprises 10 terms and focuses on the concept of bankruptcy prediction, including the terms: company performance, DEA, discriminatory analysis, large European companies, failure, financial rates, framework, models and analysis of key components. The second cluster, consisting of 8 terms, includes the concept of bankruptcy risk, Conan & Holder model, discriminant analysis, enterprise, bankruptcy risk estimation models, parameters, success rates and Z Score. The third cluster comprises 5 items, namely: agricultural holdings, Altman model, bankruptcy risk, Conan & Holder model and Romania. This cluster highlights our country's growing interest in the Conan & Holder model. The last cluster contains 4 items related to the construction sector, discriminant and multivariate analysis, multifactorial models and prediction.

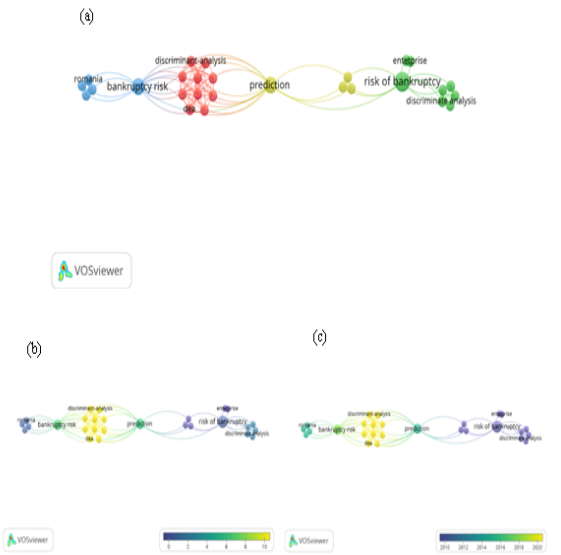

Figure 2 (a) WoS Model Conan and Holder Keyword Frequency Network (2009-2020); (b) Network visualization by frequency and average citations; (c) Network view by frequency and average year of publication
Source: the authors' own elaboration through VOSviewer software

At the same time as WoS, we applied the search protocol in Figure 3 to the SCOPUS platform, resulting in a number of 6 works for the selected period that were imported into the VOSviewer software. He selected 53 terms of which only 33 are connected to each other and at the same time reached the threshold of at least one frequency. The network of key terms shown in Figure 2 highlights two clusters of different sizes which is determined by the intensity of the links between the terms and their frequency. The first cluster consists of 17 items centered around several concepts, such as artificial intelligence, business models, concessions, economics, information management, innovation, intangible assets, regional planning, neural networks, risk perception, etc. The second cluster includes 16 specific terms such as bankruptcy risk, Altman model, Conan and Holder model, empirical research, forecast, financial situation, bankruptcy forecast, profit and loss, risk forecast, Romania and others.

From the point of view of frequency indicators and average quotes, we notice that in the case of the network of key terms based on the results provided by WoS, the most cited items are company performance, DEA, discriminant analysis, large European companies, failure, financial rates, framework, models and analysis of the main components, and for the SCOPUS database, it is not indicated which are the most cited terms (see Figure 2 (b) and Figure 3 (b)).

As shown in Figure 2 (c) and Figure 3 (c) from 2010 to 2020 the Conan and Holder model reaches the maximum point represented by the keyword frequency in 2010, and in 2015 according to the WoS network, and in 2015 according to SCOPUS.

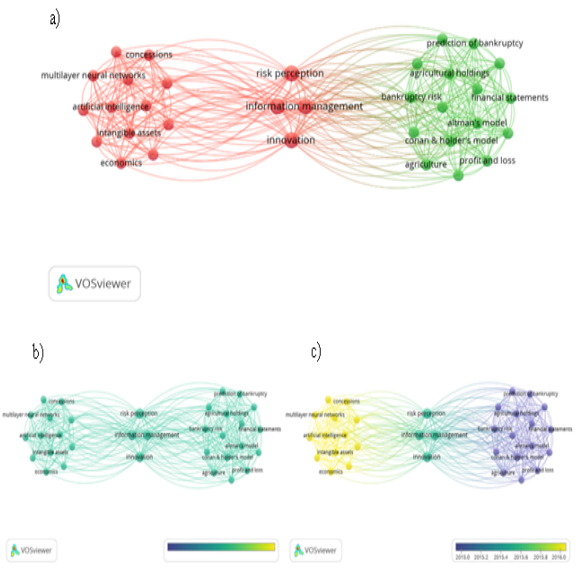

Figure 3 (a) The key frequency network for the Conan and Holder Model on SCOPUS (2010-2017); (b) Network visualization by frequency and average citations; (c) Network view by frequency and average year of publication
Source: the authors' own elaboration through VOSviewer software

Table 3 Top 10 by frequency of keywords related to Conan and Hoder Model concepts

	Top	Items	Cluster	Links	Total link strength	Occurrences	Avg. pub. year	Avg. citations
WoS	1	risk of bankruptcy	2	11	-	3	2009	0.6667
	2	bankruptcy risk	3	15	-	2	2017	6.5
	3	prediction	4	15	-	2	2015	6
	4	agricultural holdings	3	4	-	1	2015	1
	5	Altman's model	3	4	-	1	2015	1
	6	bankruptcy prediction	1	11	-	1	2020	12
	7	company performance	1	11	-	1	2020	12
	8	Conan & Holder model	2	5	-	1	2010	2
	9	Conan & Holder's model	3	4	-	1	2015	1
	10	construction sector	4	4	-	1	2010	0
SCOPUS	1	information management	1	32	35	2	2015	0
	2	innovation	1	32	35	2	2015	0
	3	regional planning	1	32	35	2	2015	0
	4	risk perception	1	32	35	2	2015	0
	5	agricultural holdings	2	19	19	1	2015	0
	6	agriculture	2	19	19	1	2015	0
	7	Altman's model	2	19	19	1	2015	0
	8	artificial intelligence	1	16	16	1	2016	0
	9	bankruptcy risk	2	19	19	1	2015	0
	10	business models	1	16	16	1	2016	0

Source: the authors' own elaboration through VOSviewer software

Table 3 shows the top 10 items by frequency, both for WoS and SCOPUS. In the case of WoS, no total link strength was presented. The top 10 keywords show that the latest research (2020) on WoS focuses on predicting bankruptcy risk and company performance, while those on SCOPUS (2016) focus on artificial intelligence and business models. The top 10 keywords of the two research platforms are different, but there are also a few common elements such as the terms bankruptcy risk, Altman's model.

3.1.1. Bibliometric analysis by authors, organizations and countries

We also analyzed the links between the authors, the organizations involved and the countries where articles on the Conan and Holder Model were published this time, using the co-authorship visualization function of the VOSviewer software, answering the question:

RQ 3: Is there international collaboration between authors, countries and institutions on the analyzed topic in order to establish the need for perfection of the evaluation models Conan & Holder model?

Based on the 6 scientific articles on the WoS platform, there are a number of 9 different authors who meet the set threshold (the number of scientific papers should be at least one per author), but four of these authors are not connected to each other; however, the network renders all 9. The 6 publications on the SCOPUS platform show a number of 10 different authors, all 10 fulfilling the aforementioned threshold.

In Table 4 we presented the top authors according to the number of published articles, along with links, number of citations, norm. citation, average publication year and average citations. We can see that the years 2010 (for WoS) and 2011 (for SCOPUS) predominate as years of publishing articles on the subject of Conan and Holder Model, and the author Bărbuță-Mișu, N. has the most appearances both in the case of WoS and in the case of SCOPUS.

Table 4 Top 8 organizations according to the number of published article

	Top	Organizations	Cluster	Links	Documents	Citations	Norm. citation	Avg. pub. year	Avg. citations
WoS	1	"Lower Danube" University, Galați	1	2	2	14	3	2015	7
	2	Bucharest Academy of Economic Studies	1	1	1	2	2	2010	2
	3	"Lower Danube" University, Galați	2	0	1	0	0	2010	0
	4	Univ. "Petru Maior", Târgu Mureș	3	0	1	0	0	2015	0
	5	"Ștefan Cel Mare" University, Suceava	4	0	1	0	1	2009	0
	6	University of Agricultural Sciences and Veterinary Medicine	5	0	1	1	2	2015	1
	7	Univ, Aveiro	6	1	1	12	1	2020	12
SCOPUS	1	Bucharest Academy of Economic Studies, Faculty of Agri-Food and Environmental Economics	1	1	1	0	1	2011	0
	2	Bucharest Academy of Economic Studies	1	1	1	0	1	2011	0
	3	Bucharest Academy of Economic Studies	2	1	1	1	1	2010	1
	4	"Lower Danube" University, Galați	3	0	1	0	1	2017	0
	5	"Lower Danube" University, Galați	2	1	1	1	1	2010	1
	6	"Ștefan Cel Mare" University, Suceava	4	0	1	0	1	2016	0
	7	University of Agricultural Sciences and Veterinary Medicine, Bucharest	5	0	1	0	1	2015	0
	8	"Lower Danube" University, Galați	6	0	1	0	1	2011	0

Source: the authors' own elaboration through VOSviewer software

From the point of view of the organizations involved in the research area Model Conan and Holder, the VOSviewer program renders for WoS 7 organizations out of a total of 7 (all meet the criterion of at least one scientific paper in an organization), and for SCOPUS the same program renders all 8 organized out of 8 with the same criteria mentioned above, stating that in the case of WoS only 3 of the 7 organizations are connected to each other. The results of the VOSviewer analysis of the top 10 most productive organizations involved are presented in Table 8. The two tops are quite different with a larger number of documents published for SCOPUS and citations for WoS. Figure 3 shows the top of the countries according to the number of documents published on the topic of Conan and Holder model, where Romania stands out as the country with the most published research in the world.

In Figure 4, based on the data collected from the WoS platform, we see that the published documents are between 1 and 6, and the second place, in terms of most publications, is occupied by Portugal. Instead, the data collected from SCOPUS highlight only Romania with the same number of publications, namely 6.

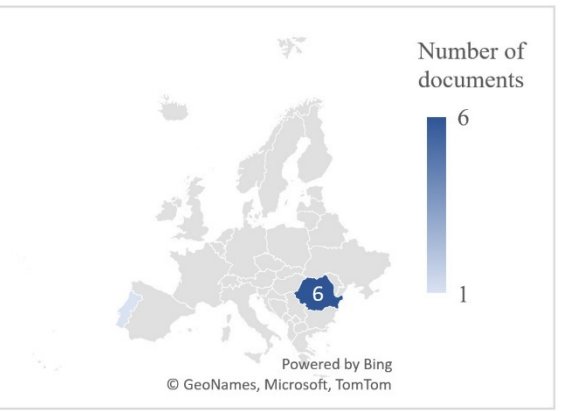

Figure 4 Number of scientific researches related to Conan and Holder Model published globally, based on data provided by WoS
Source: Developed by the authors (2019)

As we only have two countries belonging to the Conan and Holder Model documents (Romania and Portugal), we cannot present the cooperation between the top 10 countries with the number of

documents published, number of citations, average publication year and average citations made through VOSviewer. This program (VOSviewer) requires at least three countries to perform this analysis.

3.2. Bibliometric analysis of the Taffler model

The Taffler model is an internationally recognized model, founded in 1983, belonging to the Asian continental school.

RQ 1: What are the new research trends on bankruptcy risk assessment models, the Taffler model based on the WOS indexed papers in the last 5 years (2007-2021)?

RQ 2: What are the new research trends on the Taffler model based on the SCOPUS indexed papers in the period 2006-2021?

We have presented in Table 5 the top 10 of the publication sources, organizations, authors, countries involved and of the years according to the number of works published for the Taffler Model topic.

We note in Table 5 that there are more differences than similarities between the data provided by the two WoS and SCOPUS platforms. The only similarity is the top 10 authors where Agarwal V. ranks the 1st for both platforms. The differences can be seen in the publication source where the 1st place is occupied by the 9th International Days of Statistics and Economics in the case of WoS and the Corporate Ownership And Control in the case of SCOPUS, as well as for the organizations involved where the 1st place is occupied by Masaryk University BRNO in the case of WoS and the University of Turin for SCOPUS, as well as for countries where the Czech Republic ranks the 1st for WoS and the UK has the same place for SCOPUS, and, as for the publication years, 2015 is the year with the most WoS publications and 2016 for SCOPUS. It is important to note that in some charts the number of published articles is the same for each position, for example in the case of the top of the WoS publishing source, each position corresponds to a single publication article. From this point of view, the differentiation between positions is made by the WoS platform, respectively SCOPUS. Finally, when comparing the two data collection bases, there is a higher number of scientific papers published on the topic of Taffler Model on the WoS platform, compared to the number of publications on SCOPUS.

Table 5 Top 10 most productive publishing sources, organizations, authors, countries, and WoS and SCOPUS publishing years related to Taffler Model research

	Top	Publication source	NA	Organizations involved	NA	Authors	NA	Countries	NA	PY	NA
WoS	1	9th International Days of Statistics and Economics	1	Masaryk University BRNO	3	Agarwal V	2	Czech Republic	9	2015	4
	2	Accounting and Business Research	1	Cranfield University	2	Plihal T	2	UK	3	2014	3
	3	CBU International Conference Proceedings 2017 Innovations in Science and Education	1	Al Farabi Kazakh National University	1	Sponer M	2	Slovakia	2	2017	3
	4	Enterprise and Competitive Environment	1	BRNO University of Technology	1	Sponerova M	2	Germany	1	2007	2
	5	European Financial Systems 2017 Proceedings of the 14th International Scientific Conference PT 2	1	Brunel University	1	Almamy J	1	Kazakhstan	1	2019	2
	6	Financial Management of Firms and Financial Institutions 10th International Scientific Conference PTS I IV	1	Partner BW	1	Aston J	1	Lithuania	1	2016	1
	7	Financial Management of Firms and Financial Institutions Ostrava	1	Cardiff University	1	Baidildina A	1	Scotland	1	2018	1
	8	HRADEC Economic Days	1	Cent Bohemia Univ	1	Bauer J	1	US	1	-	-
	9	HRADEC Economic Days Vol 5 2	1	Kaunas University of Technology	1	Cabelova T	1	Wales	1	-	-

	10	Hradecke Ekonomicke DNY 2015 ROC 5 2	1	Kosice Technical University	1	Csikosova A	1	-	-	-	-
SCOPUS	1	Corporate Ownership And Control	2	University of Turin	2	Agarwal, V.	2	UK	3	2016	2
	2	Accounting And Business Research	1	University of Brescia	2	Giacosa, E.	2	Italy	2	2015	2
	3	Business Theory And Practice	1	Cranfield School of Management	2	Mazzoleni, A.	2	Lithuania	2	2014	2
	4	International Journal Of Financial Studies	1	Partner BW	1	Teodori, C.	2	Czech Republic	1	2007	2
	5	Journal Of Accounting And Economics	1	Financial University	1	Veneziani, M.	2	Germany	1	2021	1
	6	Journal Of Advanced Research In Law And Economics	1	Independent Researcher	1	Almamy, J.	1	Russia	1	2019	1
	7	Journal Of Banking And Finance	1	Cranfield University	1	Aston, J.	1	Slovakia	1	2006	1
	8	Journal Of Corporate Finance	1	RUDN University	1	Bauer, J.	1	US	1	2014	11
	9	Transformations In Business And Economics	1	Bratislava University of Economics	1	Bratanov, A.	1	-	-	-	-
	10	-	-	Brunel University of London	1	Halili, E.	1	-	-	-	-

* NA – number of published articles; * PY – year of publication.
Source: the authors' own development using WoS and SCOPUS databases

Based on the search protocol applied on the WoS platform mentioned in Figure 4, a number of 16 papers for the selected period resulted, these being imported into the VOSviewer software which selected 83 terms of which only 73 are connected to each other and in the same time they have reached the threshold of at least one frequency.

The frequency network of keywords or terms on the Taffler Model (Figure 5) suggests that this concept is closely related to the bankruptcy risk model (where it records a frequency of 5, with a link intensity of 24 according to VOSviewer), bankruptcy (frequency of 3 with a link of 28), bankruptcy prediction (frequency of 3 with an intensity of 24), etc. (see Table 7). From Figure 4 we see that the network groups the 73 terms into eight clusters according to their relevance. The first cluster comprises 12 terms and focuses on the concept of bankruptcy risk models, including terms such as Altman Model, Altman Model Z Score, financial performance, discriminant analysis, financial health, financial indicators, insolvency, predictive models, Taffler Index and others. The second cluster also consisting of 12 items, brings to the fore the concept of bankruptcy prediction models plus corporate bankruptcy, classical statistical models, solvency model, financial analysis, companies, implementation, artificial intelligence models, performance, probability of bankruptcy and more. The third cluster contains 10 items and focuses on the term bankruptcy prediction, economic value, financial distress, information, probability, profession, Z-score, etc. The fourth cluster comprises 9 items and focuses on the following terms: Altman, bankruptcy, competitiveness, creditworthiness, Taflller, evaluation, Z-score model, etc. The fifth cluster contains 9 terms and refers to credit risk, default prediction, distress risk, financial rates, danger modes, option price, probability of default, SME and others. The sixth cluster comprises 8 items such as: audit reports, audit, capital markets, market anomalies, market efficiency, risk, etc. The seventh cluster has 7 terms including: Altman Z-Score, bankruptcy risk model, model reliability, solvency model, Taffler model, etc. The last cluster contains 6 items that refer to discriminant analysis, financial health management, prediction methods, rates, bankruptcy risk, etc.

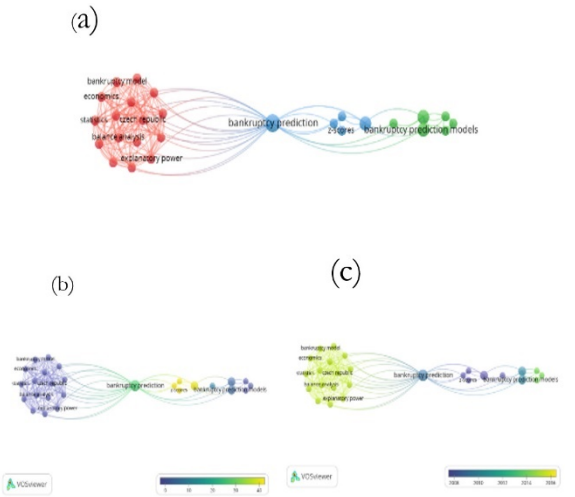

Figure 5 (a) Keyword Frequency Network for the WoS Taffler Model (2007-2019); (b) Network visualization by frequency and average citations; (c) Network view by frequency and average year of publication
Source: the authors' own elaboration through VOSviewer software

Simultaneously with WoS, we applied the search protocol in Figure 6 to the SCOPUS platform, resulting in a number of 11 papers for the selected period that were imported into the VOSviewer software. It selected 60 terms of which only 27 are connected to each other and at the same time reached the threshold of at least one frequency. The network of key terms shown in Figure 5 highlights three clusters of different sizes which is determined by the intensity of the links between the terms and their frequency. The first cluster consists of 16 items centered on the concepts of balance sheet analysis, bankruptcy model, construction industry, credibility indices, economy, individual models, information management, regional planning, analysis of reliability, model reliability, solvency model, standard deviation, statistics, etc. The second cluster (green) includes 6 specific terms such as bankruptcy, bankruptcy prediction, classical statistical models, artificial intelligence models, probability of bankruptcy and others. The last cluster groups 5 terms such as bankruptcy prediction, economic value, financial rates, Z-score, et. From the point of view of frequency indicators and average quotes, we notice that in the case of the network of key terms based on the results provided by WoS, the most cited items are financial difficulties, Z-score, probability, information, classification, profession, economic value, curve roc, type I and type II errors, financial rates, default prediction, option price, distress risk, hazard models and Basel III, and for the SCOPUS database, the most cited items were financial rates, economic value, Z-score and type I and type II errors (see Figure 5 (b) and Figure 6 (b). As shown in Figure 5 (c) and Figure 6 (c) from 2006 to 2020 the Taffler Model reaches its peak frequency in 2015 according to the WoS network, and according to SCOPUS this word (Taffler) does not appear as the keyword represented in this analysis.

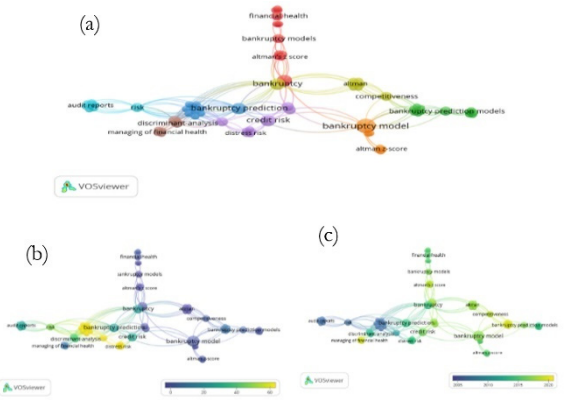

Figure 6 (a) Keyword Frequency Network for the SCOPUS Taffler Model (2006-2021); (b) Network visualization by frequency and average citations; (c) Network view by frequency and average year of publication

From the point of view of frequency indicators and average quotes, we notice that in the case of the network of key terms based on the results provided by WoS, the most cited items are financial difficulties, Z-score, probability, information, classification, profession, economic value, curve roc, type I and type II errors, financial rates, default prediction, option price, distress risk, hazard models and Basel III, and for the SCOPUS database, the most cited items were financial rates, economic value, Z-score and type I and type II errors (see Figure 5 (b) and Figure 6 (b)). As shown in Figure 5 (c) and Figure 6 (c) from 2006 (in purple) to 2020 the Taffler Model reaches its peak frequency in 2015 according to the WoS network, and according to SCOPUS this word (Taffler) does not appear as the keyword represented in this analysis.

Table 6 shows the top 10 items by frequency, both for WoS and SCOPUS.

Table 6 Top 10 by keyword frequency related to Taffler Model concepts

	Top	Terms	Cluster	Links	Total link strength	Occurrences	Avg. pub. year	Avg. citations
WoS	1	bankruptcy model	7	19	24	5	2016	3
	2	bankruptcy	4	28	28	3	2014	223.333
	3	bankruptcy prediction	3	19	24	3	2013	233.333
	4	credit risk	5	11	16	3	2016	273.333
	5	insolvency	1	11	16	3	2017	1
	6	bankruptcy models	1	9	9	2	2016	0
	7	bankruptcy prediction models	2	13	13	2	2016	6
	8	competitiveness	4	16	16	2	2018	4.5
	9	discriminant-analysis	8	18	19	2	2013	38.5
	10	financial health	1	6	6	2	2015	2.5
SCOPUS	1	bankruptcy prediction	3	23	24	3	2009	26
	2	bankruptcy prediction models	2	7	8	2	2010	5
	3	financial ratios	3	7	8	2	2006	38.5
	4	probability of bankruptcy	2	7	8	2	2010	5
	5	balance analysis	1	16	16	1	2015	1
	6	bankruptcy	2	4	4	1	2006	9
	7	bankruptcy model	1	16	16	1	2015	1
	8	classical statistical models	2	4	4	1	2014	1
	9	construction industry	1	16	16	1	2015	1
	10	credibility indices	1	16	16	1	2015	1

Source: the authors' own elaboration through VOSviewer software

The top 10 keywords show that the latest research (2018) on WoS focuses on competitiveness, while the latest research (2015) on SCOPUS focuses on the bankruptcy model, the construction industry and credibility indices. The top 10 keywords of the two search platforms are different, but there are common elements such as the terms bankruptcy model, bankruptcy, bankruptcy prediction and bankruptcy prediction models.

3.2.1. Bibliometric analysis by authors, organizations and countries

In the following section we also analyzed the links between the authors, the organizations involved and the countries where articles on the topic of the Taffler Model were published this time, using the co-authorship visualization function of the VOSviewer software.

RQ 3: Is there international collaboration between authors, countries and institutions on the analyzed topic in order to establish the need for perfection of the evaluation models, Taffler model?

Based on the 16 scientific articles on the WoS platform, there are a number of 33 different authors who meet the set threshold (the number of scientific papers should be at least one per author), and only 4 of them are connected to each other; however, we selected the program to display all 33 authors. From the 11 publications on the SCOPUS platform, a number of 26 different authors emerge, and of these, only 5 are connected to each other; however, we selected the program to display all 26 authors.

In Table 7 we presented the top of the authors according to the number of published articles, along with links, number of citations, norm. citation, average publication year and average citations. We can see that the years 2017 (for WoS) and 2015 (for SCOPUS) predominate as years of publishing articles on the subject of Taffler Model.

Table 7 Top 10 authors by number of published articles

	Top	Author	Cluster	Links	Total link strength	Documents	Citations	Avg. pub. year	Avg. citations
WoS	1	Agarwal, V.	4	2	2	2	146	2010	73
	2	Plihal, T.	7	2	4	2	3	2017	1.5
	3	Sponer, M.	7	2	4	2	3	2017	1.5
	4	Sponerova, M.	7	2	4	2	3	2017	1.5
	5	Almamy, J.	3	2	2	1	52	2016	52
	6	Aston, J.	3	2	2	1	52	2016	52
	7	Baidildina, A.	1	3	3	1	0	2017	0
	8	Bauer, J.	4	1	1	1	79	2014	79
	9	Cabelova, T.	1	3	3	1	0	2017	0
	10	Csikosova, A.	5	2	2	1	10	2019	10
SCOPUS	1	Agarwal, V.	4	2	2	2	147	2010	73.5
	2	Giacosa, E.	1	4	7	2	6	2015	3
	3	Mazzoleni, A.	1	4	7	2	6	2015	3
	4	Teodori, C.	1	4	7	2	6	2015	3
	5	Veneziani, M.	1	4	7	2	6	2015	3
	6	Almamy, J.	3	2	2	1	52	2016	52
	7	Aston, J.	3	2	2	1	52	2016	52
	8	Bauer, J.	4	1	1	1	79	2014	79
	9	Bratanov, A.	5	2	2	1	1	2019	1
	10	Halili, E.	1	4	4	1	4	2016	4

Source: the authors' own elaboration through VOSviewer software

Compared to the previously analyzed results based on WoS, the top 10 authors in the field of research on the Taffler model according to SCOPUS is slightly different, there are authors who are the same but occupy different positions.We notice that only the 1st place is occupied by a single author, namely Agarwal, V. who has the most citations (146 for WoS and 147 for SCOPUS).

The most cited authors (after the 1st place) for both WoS and SCOPUS are Bauer, J., Almamy, J. and Aston, J.

Table 8 Top 10 organizations by number of articles published

	Top	Organizations	Cluster	Links	Total link strength	Documents	Citations	Avg. pub. year	Avg. citations
WoS	1	Masaryk Univ.	6	0	-	3	3	2017	1
	2	Cranfield Sch Management	2	2	-	2	146	2010	73
	3	Al Farabi Natl Univ.	1	2	-	1	0	2017	0
	4	Brno Univ. Technol.	4	0	-	1	0	2015	0
	5	Brunel Univ.	3	1	-	1	52	2016	52
	6	Bw Partner	2	1	-	1	79	2014	79
	7	Cent Bohemia Univ.	1	2	-	1	0	2017	0
	8	Kaunas Univ. Technol	5	0	-	1	3	2014	3
	9	Tech Univ.	7	0	-	1	0	2015	0
	10	Tech. Univ. Kosice	8	0	-	1	10	2019	10
SCOPUS	1	University of Russia (Rudn University), Moscow	1	3	3	1	1	2019	1
	2	Bw Partner, Germany	3	1	1	1	79	2014	79
	3	Brunel University, United Kingdom	2	1	1	1	52	2016	52
	4	Financial University, Russian Federation	1	3	3	1	1	2019	1
	5	Cranfield School of Management, United	3	1	1	1	79	2014	79

	Kingdom							
6	Cranfield School of Management, United Kingdom	4	1	1	1	68	2007	68
7	University of Edinburgh, United Kingdom	4	1	1	1	68	2007	68
8	Kaunas University of Technology, Lithuania	7	0	0	1	1	2014	1
9	Brno University of Technology, Czech Republic	8	0	0	1	1	2015	1
10	University of Economics in Bratislava, Slovakia	5	1	1	1	0	2021	0

Source: the authors' own elaboration through VOSviewer software

From the point of view of the organizations involved in the Taffler Model research area, the VOSviewer program renders for WoS 18 organizations out of a total of 18 (all of which meet the criterion of at least one scientific paper in an organization, but only 3 of them are connected to each other), and for SCOPUS the same program renders all 18 organizations out of 18 (of which only 4 are connected to each other) with the same criteria mentioned above, resulting in 10 clusters in SCOPUS and 13 clusters in WoS

The results of the VOSviewer analysis of the top 10 most productive organizations involved are shown in Table 8. The two tops are quite different with a larger number of documents published for WoS and citations for SCOPUS.

Figure 7 and Figure 8 show the top 10 countries by number of papers published on the subject of the Taffler Model, where the Czech Republic stands out in the case of WoS and the United Kingdom in the case of SCOPUS as the countries with the most published research in th the world.

Based on the data collected from the WoS platform, we notice that the published documents are between 1-9, and the second and third place are occupied by England and Slovakia (Figure 7).

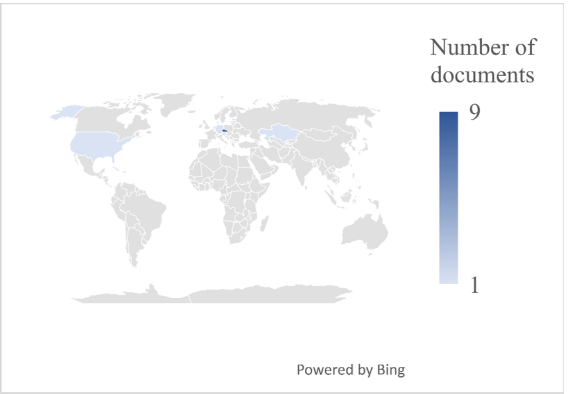

Figure 7 Number of scientific researches related to the Taffler Model published globally, based on data provided by WoS
Source: the authors' own elaboration through Microsoft 365 software, 2019

On the other hand, the data collected from SCOPUS show a lower number of published studies related to the Taffler Model, ranging from 1 to 3, where the second place is occupied by Italy and the third place by Lithuania (Figure 8). The VOSviewer program renders for WoS, in terms of countries, 9 countries out of a total of 9 (all of which meet the criterion of at least one scientific paper in a country, but only 4 are connected to each other), and for SCOPUS 8 countries out of a total of 8, all meeting the same criteria

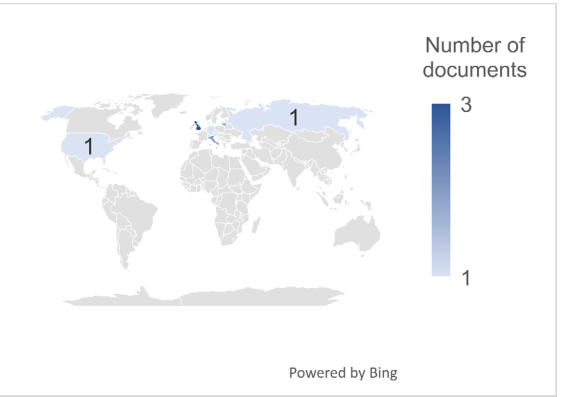

Figure 8 Number of scientific researches related to the Taffler Model published globally, based on data provided by SCOPUS
Source: the authors' own elaboration through Microsoft 365 software, 2019

Table 9 shows the cooperation between the top 9 countries with the number of documents published, number of citations, average publication year and average citations made through VOSviewer. Note that the years 2007 (WoS) and 2015 (SCOPUS) were the peak of Taffler Model publications for several countries. The growing interest of countries such as England, the United Kingdom and Germany in the Taffler Model is also reflected in the number of citations recorded by them (for example in the case of Germany 79 citations for both WoS and SCOPUS).

Table 9 Top 9 countries by number of articles published

	Top	Country	Cluster	Links	Documents	Citations	Norm. citation	Avg. pub. year	Avg. citations
WoS	1	Czech Republic	2	1	9	11	8	2015	12.222
	2	England	1	3	3	198	53.468	2012	66
	3	Slovakia	5	0	2	19	2	2019	9.5
	4	Germany	3	1	1	79	28.902	2014	79
	5	Kazakhstan	2	1	1	0	0	2017	0
	6	Lithuania	4	0	1	3	0.1098	2014	3
	7	Scotland	1	1	1	67	14.565	2007	67
	8	USA	6	0	1	25	0.5435	2007	25
	9	Wales	1	1	1	52	1	2016	52
SCOPUS	1	UK	1	1	3	199	52.945	2012	663.333
	2	Italy	3	0	2	6	14.762	2015	3
	3	Lithuania	4	0	2	10	1.025	2010	5
	4	Czech Republic	2	0	1	1	0.6667	2015	1
	5	Germany	1	1	1	79	1.975	2014	79
	6	Russia	5	0	1	1	1	2019	1
	7	Slovakia	6	0	1	0	1	2021	0
	8	USA	7	0	1	25	0.5376	2007	25
	9	-	-	-	-	-	-	-	-

Source: the authors' own elaboration through VOSviewer software

3.3. Results and discussions on the content analysis of the Conan & Holder and Taffler models

The economic and financial activity of any enterprise can be carried out under the most varied circumstances and risks. There are, therefore, many concerns for analyzing the prospect of the risk effect of a company. Bankruptcy risk analysis methods, as a whole, are the quantitative approach to a company's crisis forecasting methodology. The essence of this approach consists of determining some normative, critical quantities of the analytical indicators or their combination, which characterize the economic-financial state of the enterprise. If the actual magnitudes of these indicators exceed the normative magnitudes, this means an increase in the probability of the financial crisis occurring in the enterprise. The analysis performed in this section of the paper shows the linear combination of rates of return and financial equilibrium, a combination that helps determine an indicator called score, through which the risk of bankruptcy of the company is approximated. The Conan & Holder model defines 5 variables and the Taffler model 4 variables. These indicators are also called score functions or Z functions and the general determination models are presented and analyzed in this section

3.3.1. Conan & Holder Model (1979)

The Conan and Holder model is included in the statistically tested models. The sample was framed by the two authors in the period 1970-1975, comprising 95 small and medium-sized companies with an industrial profile. In this sample, the financial accounting variables of each company were studied. The first set of indicators included in the initial score function included 50 indicators classified by categories, namely: asset structure, financial dependence, working capital, operation, treasury, profitability, etc.

The final score function can be applied to the following enterprises classified by activity category (Anghel, 2002):

- wholesale businesses;
- industrial enterprises;
- construction companies;
- transport companies.

In the table below (Table 10) we can see the rates that make up the Conan and Holder model:

Table 10 Financial-accounting rates contained in the Conan & Holder model

Rate number	Name rate	Calculation method
R1	Profitability from creditors	E.B.E / Total debts
R2	Liquidity	Also available short-term realizable values / Total liabilities
R3	Solvency	Equity / Total liabilities
R4	Staff spending rate	Staff costs / Value added

R5	Rate of financial expenses	Financial expenses / Turnover

Source: Adaptation after Conan & Holder, 1979

The structure of the model is:

$$\mathbf{Z} = 0{,}24\ R1 + 0{,}22\ R2 + 0{,}16\ R3 - 0{,}87\ R4 - 0{,}10\ R5$$

Table 11 Reference ranges in the Conan and Holder model

Z < 4 %	4% < Z < 9%	Z > 9%
Danger	Caution	Good situation
P > 65%	30% < P < 65%	P < 30 %

where P = probability

Source: Adaptation after Conan & Holder, 1979

It should be noted that, according to the authors, this score function allows the forecast of 75% of actual bankruptcies and triggers alarm signals for business management to deepen the examination of business instability and to take measures to remedy financial health (if the situation is an irreparable one).

3.3.2. The Taffler Model (1983)

The Taffler model is composed of fewer financial accounting rates than previous model. The model we are talking about now contains 4 explanatory variables. The financial accounting information in the financial reporting used in the Taffler model comprises: Current Assets, Gross Profit, Total Liabilities, Current Liabilities, Total Assets and Sales. The formula can be seen below:

$$Z = 0.53\ X1 + 0.13\ X2 + 0.18\ X3 + 0.16\ X4$$

where:

X1= Gross profit / Current debts, Current debts = debts less than one year;

X2=Current Assets / Total Liabilities;

X3= Current Debts / Total Assets;

X4= Sales / Total Assets.

Depending on the values for X, the Z score is calculated and interpreted according to Table 13.

Table 12 Reference ranges in the Taffler model

Value score	Interpretation
Z<=0.2	High probability level
0.2<Z<0.3	Undecided
Z>=0.3	Low probability

Source: the authors' own adaptation after Bordeianu, Radu, Paraschivescu & Pavaloaia, 2011

As it can be seen in the table above, when the score is in the range of 0.2-0.3, the model has no results related to the financial situation of the company.

Following the review of scientific literature and the bibliometric analysis performed, we found that the topic of bankruptcy risk and evaluation models benefits from the constant attention of researchers, which is why it should not only be treated as a simple topic of research, but as a permanent concern for academic environment and the practitioners, in order to identify and propose new solutions and models to prevent the risk of bankruptcy, considering that the global economy is increasingly oriented towards online environment. In this context, the results of the bibliometric analysis support this statement, since each resulting cluster has a structure that practically leads us to the future research trends regarding companies in crisis.

Conclusions

The risk of bankruptcy has been, is and will be the subject of many research studies to identify the factors that contribute to insolvency and the indicators that best express this direction. The present article addresses a current issue of a particular importance in the tumultuous economic context of the last period triggered by the pandemic crisis.

Following the bibliometric analysis, it was found that most of the studies focus on an analysis of the efficiency of bankruptcy risk assessment methods and on the identification of new methods that provide risk predictability. In this sense, there has been an increase in the number of works with inter-institutional and country collaborations that allow the analysis of the determinants of bankruptcy risk. At the same time, the research results showed that the main research trends, as we mentioned before, focus on the predictability of risk. This. is only possible through the complete analysis of the business environment of which the company is a part and the identification of all the determining factors that lead to bankruptcy .

This paper first highlights the main research trends in bankruptcy risk assessment models, projecting an overview of the literature in the field. Thus, according to the results of the research it is noted that the number of papers with the topic "bankruptcy risk prediction" or "bankruptcy risk assessment models" in the period of 2006-2021 had a rather slow growth, practically of all the existing publications, most of whidh were published in the period of 2008-2009, when the world economies were affected by the economic crisis. The research

results are in agreement with Shi and Li (2019), who conducted a bibliometric analysis to highlight the progress of inligent techniques in bankruptcy predictions, concluding that "although there is a significant increase in the number of publications since the 2008 financial crisis, collaboration among authors is weak, especially at the international dimension." The research results were also confirmed by Yu et. al. (2010), as well as by Prado et al. (2016), who argue that an increase in the number of publications was observed after the 2008-2009 financial crisis. Basically, the economic crisis has underlined the need of co-authorship analyses, which, according to Liao et al. (2018), investigates "the level of collaborative research strengths in a specific field" and based on this analysis, we can see that collaboration between authors is weak.

In the light of current economic realities and overlapping crises (health, military, political, energetic, economic), the international business environment has been severely affected, with an increase in the number of insolvent companies. In this context, the need to design new models for assessing bankruptcy risk or to adapt current models to today's economic realities is highlighted, so that companies can prevent the materialization of their risks and not just detect them in the terminal phase.

Summarizing the conclusions of this paper, we note that:

- The Conan & Holder model consists of 5 financial-accounting installments, as we observed in the second part of the paper. The scientific output for this topic – Conan and Holder Model – was low, resulting in 6 scientific papers for both WoS and SCOPUS (12 scientific papers in total). It was observed in the analyzed period (2009-2020 for WoS and 2010-2017 for SCOPUS) that in the case of the network of key terms based on the results provided by WoS, the most cited items are company performance, DEA, discriminant analysis, large European companies, failure, financial rates, framework, models and analysis of the main components, and for the SCOPUS database, it is not indicated which are the most cited terms. The most cited author on the topic of Conan & Holder model for both platforms (WoS and SCOPUS) is Bărbuță-Mișu, N., and Romania ranks first in the top of the most productive countries for both scientific search engines.
- The Taffler model includes 4 variables, and in terms of the basis of the search protocol applied on the WoS platform, 16 papers for the period was a number of 2007-2019, and the basis of the search protocol applied on the SCOPUS platform was a number of 11 papers for period 2006-2021. It was found that in the case of the network of key terms based on the results provided by WoS, the most cited items on the topic of Taffler model are financial difficulties, Z-score, probability, information, classification, profession, economic value, rock curve, type I and type II errors, financial rates, default prediction, option price, risk of distress, hazard models and Basel III, and for the SCOPUS database, the most cited items were financial rates, economic value, Z-score and errors of type I and type II. The most cited author on the Taffler model for both platforms (WoS and SCOPUS) is Agarwal, V. Depending on the number of papers published on the Taffler model, the Czech Republic stands out in the case of WoS and the United Kingdom in the case of SCOPUS as the countries with most published research in the world.

We consider that the bibliometric analysis on this topic based on all the publications available in the 2 international databases with international scientific recognition are of a real support in clarifying the problems related to the assessment of the risk of bankruptcy of companies, but especially in identifying relevant areas of interest for the authors of the publications in the context of the topic of these models of risk assessment of bankruptcy. These issues are particularly important because they create the preconditions for creating a real framework for scientific debate about existing trends in research and the problems and gaps faced by managers, business owners and all other stakeholders, which can obviously lead to serious debates about these issues and providing viable solutions for optimizing bankruptcy risk assessment models.

In the same vein, we conclude that risk predictability is an emerging theme that needs to be addressed by the authors, especially now that the business environment is threatened by overlapping crises. Thus, the present research can be the starting point for researching and adapting bankruptcy risk assessment models to the current economic context. The present research highlights the paucity of literature analysing bankruptcy risk and predictability methods.

Our study limitations are mainly due to the bibliometric algorithm, in the sense that only papers indexed in WoS and Scopus can be imported, processed, and interpreted, which excludes parts of the existing literature on this topic

and omits the analysis of some pertinent contributions to our research area. This research can be used as a cornerstone for new research directions, both quantitative and qualitative, on the mechanism of application of bankruptcy risk prevention methods.

References

Agarwal, V., & Taffler, R. J. (2007). Twenty-five years of theTaffler z-score model: Does it really have predictive ability?. *Accounting and business research*, 37(4), 285-300. https://doi.org/10.1080/00014788.2007.9663313

Aglietta, M. (2008). La crise etouffe progresivement les economies occidentales. *Le Monde*, 16. Retrieved February 25, 2022, from https://www.lemonde.fr/l

Al Husaeni, D.F. & Nandiyanto, A.B.D. (2022). Bibliometric using Vosviewer with Publish or Perish (using google scholar data): from step-by-step processing for users to the practical examples in the analysis of digital learning articles in pre and post COVID-19 pandemic. *ASEAN Journal of Science and Engineering*, 2(1), 19-46. https://doi.org/10.17509/ajse.v2i1.37368

Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial distress prediction in an international context: a review and empirical analysis of Altman's Z-score model. *Journal of International Financial Management & Accounting*, 28(2), 131-171. https://doi.org/10.1111/jifm.12053

Anghel, I. (2002). Falimentul. Radiografie și predicție. Economică, Romania, Bucharest. Antonowicz, P. (2015). Bankructwa i upadłość przedsiębiorstw. Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk, Poland.

Arieshanti, I., Purwananto, Y., Ramadhani, A., Nuha, M. U., & Ulinnuha, N. (2013). Comparative study of bankruptcy prediction models. *Telkomnika, 11(*3), 591-596. https://doi.org/10.12928/telkomnika.v11i3.1143

Armeanu, S. D., Vintilă, G., Moscalu, M., Filipescu, M. O., & Lazăr, P. (2012). Utilizarea tehnicilor de analiză. Economie teoretică și aplicată 1(566), 86-102.

Bărbuţă-Mişu, N., & Codreanu, E. S. (2014). Analysis and prediction of the bankruptcy risk in Romanian building sector companies. *Ekonomika*, 93(2), 131-146. https://doi.org/10.15388/Ekon.2014.2.3542

Bărbuță-Mișu, N., & Madaleno, M. (2020). Assessment of bankruptcy risk of large companies: European countries evolution analysis. *Journal of Risk and Financial Management*, 13(3), 58. https://doi.org/10.3390/jrfm13030058

Blănculescu, I. (2006). Gestionarea situațiilor de criză la nivelul companiei. Săptămâna financiară Newspaper, 62. Retrieved April 17, 2022 from: https://www.sfin.ro

Blume, J., Kieser, M., & Holscher, U. (1998). The declining credit quality of U. S. corporate debt: myth or reality. *Journal of Finance, 4,* 1389-1413. https://doi.org/10.1111/0022-1082.00057

Boratyńska, K. (2021). A New approach for Risk of corporate bankruptcy assessment during the COVID-19 pandemic. *Journal of Risk and Financial Management*, *14*(12), 590. https://doi.org/10.3390/jrfm14120590

Bordeianu, G. D., Radu, F., Paraschivescu, M. D., & Pavaloaia, W. (2011). Analysis models of the bankruptcy risk. *Economy Transdisciplinarity Cognition*, *14*(1), 248-259.

Borner, K., Chen, C. & Boyack, K. (2005). Visualizing knowledge domains. Annu. *Rev. Inf. Sci. Technol*., *37* (1), 179-255.

Cantor, C. & Parker, M. (1994). Credit derivatives, disintermediation, and investment decisions. *The University of Chicago: The Journal of Business*, 78, 621-648. https://doi.org/10.1086/427641

Charitou, A., Neophytou, E., & Charalambous, C. (2004). Predicting corporate failure: empirical evidence for the UK. *European Accounting Review*, 13(3), 465-497. https://doi.org/10.1080/0963818042000216811

Chelba, A. A. & Grosu, V. (2021). Effects of financial crisis on the activity of economic entities and on relations with stakeholders. *European Journal of Accounting, Finance & Business*, 16(26), 1-8. https://doi.org/104316/EJAFB.2021.9210

Cicea, C., Marinescu, C., Albu, C.F. & Balan, P.D. (2019). Applying bibliometric mapping and clustering on research regarding biomass related innovation, in *Proceedings of 33rd IBIMA Conference*: 10-11 April 2019, Granada, Spain, 2404-2419 .

Cicea, C., Leftiris, T., Marinescu, C., Popa, Ș.C. & Albu, C.F. (2021). Applying text mining technique on innovation-development relationship: a joint research agenda. *Economic Computation and Economic Cybernetics Studies and Research*, 1(55).

Cho, E., Okafor, C., Ujah, N., & Zhang, L. (2021). Executives' gender-diversity, education, and firm's bankruptcy risk: Evidence from China. *Journal of Behavioral and Experimental Finance*, *30*, 100500. https://doi.org/10.1016/j.jbef.2021.100500

Conan, J., & Holder, M. (1979). Variables explicatives de performances et controle de gestion dans les P.M.I. Doctoral thesis in Management Sciences, Paris Dauphine University, Paris, France.

Cvilikas, A., Kurschus, R. J., & Šarapova, T. (2015). The criteria to identify company's crisis in SME sector. *Engineering Economics*, 26(2), 152-158. https://doi.org/10.5755/j01.ee.26.2.8779

Dankiewicz, R., Simionescu, M. (2020). The insurance market in romania: a macroeconomic and a microeconomic approach, *Transformations in Business & Economics* , 19(1), 49. do Prado, J., de Castro Alcantara, V., de Melo, Carvalho, F.,

Vieira, K., Machado, L. & Tonelli, D. (2016). Multivariate analysis of credit risk and bankruptcy research data: a bibliometric study involving different knowledge fields (1968–2014), *Scientometrics*, *106* (3), 1007-1029. https://doi.org/10.1007/s11192-015-1829-6

Dubrovski, D. (2004). Peculiarities of managing a company in crisis. *Total quality management & business excellence*, *15*(9-10), 1199-1207. https://doi.org/10.1080/1478336042000255578

Dwyer, D., & Stein, R. (2006). Inferring the default rate in a population by comparing two incomplete default databases. *Journal of Banking & Finance*, 30(3), 797–810. https://doi.org/10.1016/j.jbankfin.2005.11.001

Echchakoui, S. (2020). Why and how to merge Scopus and Web of Science during bibliometric analysis: the case of sales force literature from 1912 to 2019. *Journal of Marketing Analytics*, *8*(3), 165-184. https://doi.org/10.1057/s41270-020-00081-9 .

Forster, B., Ward, T., & Woodroof, J. (1998). An analysis of the usefulness of debt defaults and going Concern opinions in bankruptcy risk. *Journal of Accounting, Auditing and Finance, 13*(3), 351-367. https://doi.org/10.1177/0148558X9801300311

Gupton, G. M. (2005). Advancing loss given default prediction models: how the quiet have quickened. *Economic Notes, 34*(2), 185-230. https://doi.org/10.1111/j.0391-5026.2005.00149

Grosu, V., Botez, D., Melega, A., Kicsi, R., Mihaila, S.,Macovei, A. – G. (2022). Bibliometric analysis of the transformative synergies between blockchain and accounting in the uprooting of economic criminality. *Entrepreneurship and Sustainability Issues, 9*(4), 77-105. http://doi.org/10.9770/jesi.2022.9.4(3)

Grosu, V. & Chelba, A.A. (2020). Bankruptcy risk - concepts and approaches in the economic literature. *European Journal of Accounting, Finance & Business*, 14(24), 1-9. https://doi.org/104316/EJAFB.2020.8314

Inam, F., Inam, A., Mian, M. A., Sheikh, A. A., & Awan, H. M. (2019). Forecasting bankruptcy for organizational sustainability in Pakistan: using artificial neural networks, logit regression, and discriminant analysis. *Journal of Economic and Administrative Sciences*, 35(3), 183-201. https://doi.org/10.1108/JEAS-05-2018-0063

Kliestik, T., Misankova, M., Valaskova, K., & Svabova, L. (2018). Bankruptcy prevention: new effort to reflect on legal and social changes. *Science and Engineering Ethics*, 24(2), 791-803. https://doi.org/10.1007/s11948-017-9912-4

Klodāne, A., Mietule, I., & Beinaroviča–Litvinova, I. (2017). systems of company's financial crisis diagnostics. In *Society. Integration. Education. Proceedings of the International Scientific Conference 4*, 246-256. https://doi.org/10.17770/sie2017vol4.2407

Krystek, U. (1987). Unternehmungskrisen: Beschreibung, Vermeidungu. Bewiltigung iiberlebenskrit. Prozesse in Unternehmungen. Gabler, Wiesbadenden, Germany.

Liao, H., Tang, M., Luo, L., Li, C., Chiclana, F. & Zeng, X. (2018). A bibliometric analysis and visualization of medical big data research. *Sustainability*, 10 (2), 166.

Meekaewkunchorn, N., Szczepańska-Woszczyna, K., Muangmee, C., Kassakorn, N., & Khalid, B. (2021). Entrepreneurial orientation and SME performance: *the* mediating role of learning orientation. *Economics and Sociology*, *14*(2), 294-312. https://doi.org/10.14254/2071-789X.2021/14-2/16

Melega, A. (2022). Bibliometrical analysis of scientific production regarding the harmonization of accounting in BRICS emerging economies. *European Journal of Accounting, Finance & Business*, *10*(1), 11-20.

Mongeon, P. & Paul-Hus, A. (2016). The journal coverage of Web of Science and Scopus: a comparative analysis. *Scientometrics*, *106*, 213-228. https://doi.org/10.1007/s11192-015-1765-5

Miţul, A., & Odainîi, D. (2018). Metode de determinare a riscului de faliment la SA "Vibromaș". Retrieved March 23, 2022, from

http://repository.utm.md/handle/5014/348

Neskorodieva, I., Megits, N., Rodchenko, V., Pustovhar, S., & Stamatin, O. (2019). The methodical approach of bankruptcy probability estimation in an anti-crisis management system of enterprise. *Journal of Eastern European and Central Asian Research*, *6*(2), 259-269. https://doi.org/10.15549/jeecar.v6i2.332

Nguyen, T. T., & Kien, V. D. (2022). Leverage and bankruptcy risk - evidence from maturity structure of debt: an empirical study from Vietnam. *The Journal of Asian Finance, Economics and Business*, *9*(1), 133-142.

Pasternak-Malicka, M., Ostrowska-Dankiewicz, A., & Dankiewicz, R. (2021). Bankruptcy - an assessment of the phenomenon in the small and medium-sized enterprise sector - case of Poland. *Polish Journal of Management Studies*, 24(1), 250-267. https://doi.org/10.9770/jssi.2020.10.2(15)

Pisula, T. (2020). An ensemble classifier-based scoring model for predicting bankruptcy of polish companies in the Podkarpackie Voivodeship. *Journal of Risk and Financial Management*, *13*(2), 37. https://doi.org/10.3390/jrfm13020037.

Pritchard, A. (1969). Statistical bibliography or bibliometrics. *Journal of documentation*, 25(4), 348-349. https://doi.org/10.1108/eb026482

Sánchez, A. D., Del Río, M. D. L. C., & García, J. Á. (2017). Bibliometric analysis of publications on wine tourism in the databases Scopus and WoS. *European Research on Management and Business Economics*, *23*(1), 8-15. https://doi.org/10.1016/j.iedeen.2016.02.001.

Singh, V. K., Singh, P., Karmakar, M., Leta, J., & Mayr, P. (2021). The journal coverage of Web of Science, Scopus and Dimensions: a comparative analysis. *Scientometrics*, *126*(6), 5113-5142. https://doi.org/10.1007/s11192-021-03948-5.

Taffler, R. J. (1983). The assessment of company solvency and performance using a statistical model. *Accounting and Business Research*, 13(52), 295-308. https://doi.org/10.1080/00014788.1983.9729767

Tsvetkova, L., Bugaev, Y., Belousova, T., & Zhukova, O. (2021). Factors affecting the performance of insurance companies in *the* Russian Federation. *Montenegrin Journal of Economics*, 17(1), 209-218. https://doi.org/10.14254/1800-5845/2021.17-1.16

Ulmer, R. R., Sellnow, T. L., & Seeger, M. W. (2007). *effective crisis communication*. New Jersey: Lawrence Erlbaum Associates, Inc.

Valackienė, A., & Virbickaitė, R. (2011). Conceptualization of crisis situation in a company. *Journal of Business Economics and Management*, *12*(2), 317-331. https://doi.org/10.3846/16111699.2011.575192

Vîrcolici, A. (2019, september). Cercetarea metodelor şi tehnicilor de estimare a riscurilor bugetar-fiscale aferente activităţii entităţilor economice cu proprietate publică. In: *competitivitate şi inovare în economia cunoaşterii: conf. şt. intern*., ed. a 21-a: Lucrări ştiinţifice, Chişinău: ASEM, 2019, pp. 719-725.

van Eck, N. J. & Waltman L. (2010). Software Survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* , 84/2: 523–38.

Voda, A. D., Dobrotă, G., Ţîrcă, D. M., Dumitrașcu, D. D., & Dobrotă, D. (2021). Corporate bankruptcy and insolvency prediction model. *Technological and Economic Development of Economy*, 27(5), 1039-1056. https://doi.org/10.3846/tede.2021.15106

Waltman, L., van Eck, N. J., & Noyons, E. C. M. (2010). A unified approach to mapping and clustering of bibliometric networks. *Journal of Informetrics*, *4*(4), 629-635. https://doi.org/10.1016/j.joi.2010.07.002

Wu, W. W. (2010). Beyond business failure prediction. *Expert systems with applications*, *37*(3), 2371-2376. https://doi.org/10.1016/j.eswa.2009.07.056

Yin Shi, Xiaoni Li, (2019). A bibliometric study on intelligent techniques of bankruptcy prediction for corporate firms. *Heliyon*, *5*(12). https://doi.org/10.1016/j.heliyon.2019.e02997.

Yu, L., Yue, W., Wang, S. & Lai, K.K. (2010). Support vector machine based multiagent ensemble learning for credit risk evaluation. *Expert Syst. Appl.,* 37 (2) (2010), 1351-1360. https://doi.org/10.1016/j.eswa.2009.06.083

✉ **Correspondence**

Anatol Melega

Stefan cel Mare University, Faculty of Economics, Administration and Business, Department of Accounting, Audit and Finance, Suceava, Romania,

E-mail: melega.anatol@usm.ro