РОЗДІЛ 4. ЕКОНОМІКА ТА УПРАВЛІННЯ ПІДПРИЄМСТВАМИ

THE DEFINITION OF FINANCIAL DISTRESS OF LISTED COMPANIES: A COMPARATIVE ANALYSIS OF WESTERN COUNTRIES AND CHINA

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Financial distress refers to the deterioration of the company's financial situation and the inability to repay debts on time. Bankruptcy is its most serious situation. With the development of statistical theory and methods, more and more predictive models and algorithms have been proposed to continuously improve the accuracy and practicability of financial distress prediction. This paper uses the comparative research method to sort out the definition of financial distress by Western scholars and Chinese scholars and provides a new perspective for the financial status and financial distress prediction of listed companies. Western scholars have proposed financial distress based on bankruptcy, cash flow, and non-financial indicators. The definition of bankruptcy is the initial stage of the study of financial distress in Western countries. With the expansion of the disclosure scope of listed companies' operating data, financial definitions of other perspectives have begun to emerge. The cash flow model suggests that the probability of a company's financial distress increases as liquid assets decrease, operating expenses increase, abnormal changes in liquidity inflows and outflows, and industry declines. The non-financial indicator reflects information about the operating environment, business processes, and results of listed companies. Chinese scholars have proposed a definition based on special treatment, cash flow, and bankruptcy. The China Securities Regulatory Commission (CSRC) has implemented a special treatment (ST) system for listed companies with financial problems and operational management problems. Most Chinese scholars use ST as a sign that listed companies are caught in financial difficulties. Based on cash flow research, the company's insufficient solvency generally consists of two forms: lack of existing and insufficient flow. Based on the definition of bankruptcy, financial distress is a serious loss and cannot repay the debt due. Western scholars often use statistical analysis of financial ratios and financial statement data, and quantitative analysis methods are used more. Chinese scholars have more deductions from the theoretical perspective, and the number of empirical studies is relatively small. The artificial intelligence method is more abstract in the classification of financial distress, although the accuracy is high, the transparency is low. A detailed classification of financial conditions and then the application of artificial intelligence methods for classification is a possible way to improve the transparency of artificial intelligence methods. To improve the transparency of financial distress prediction based on artificial intelligence, it is necessary to build a more transparent prediction model. First, the financial situation is broken down into multiple levels based on financial and non-financial indicator data. Then, establish a prediction model based on financial statement data, cash flow indicators, corporate governance, macroeconomic indicators, and other factors. Finally, choose the appropriate artificial intelligence algorithm for prediction.

Key words: *financial distress, definition, listed companies, stock exchanges, bankruptcy, cash flow, comparison*

Фінансові розлади стосуються погіршення фінансового стану компанії та неможливості своєчасно погасити борги, що часто досягають найсерйознішої ситуація – банкрутства. З розвитком статистичної теорії та методів все більше і більше передбачуваних моделей і алгоритмів було запропоновано, що постійно підвищували точність і практичність прогнозування фінансових розладів. Оскільки публічні компанії поглинають велику кількість коштів інвесторів по всьому світу, і вони, як правило, мають велику кількість зацікавлених сторін актуальним є дослідження питання передбачення фінансового стану компанії на основі відкритої фінансової інформації. Для акціонерів, інвесторів, керівництва, співробітників та інших зацікавлених сторін важливо точно передбачити економічний статус компаній, що котируються на біржах, що може зменшити потенційні втрати зацікавлених сторін. У цій статті за допомогою методу порівняльного дослідження, автор аналізує підходи до визначення фінансових труднощів західними вченими та китайськими вченими, і надає нову перспективу для фінансового стану та прогнозування фінансових труднощів компаній, що котируються на біржі. Західні вчені аналізують фінансові розлади на основі банкрутства, грошових потоків і нефінансових показників. Визначення банкрутства є початковим етапом дослідження фінансових труднощів у західних країнах. З розширенням обсягів розкриття операційних даних компаній, зареєстрованих на біржі, почали формуватися фінансові визначення інших перспектив. Модель потоку грошових коштів свідчить про те, що ймовірність фінансового лиха компанії зростає в міру зменшення ліквідних активів, збільшення операційних витрат, аномальних змін припливу і відтоку ліквідності, і спаду у секторів, в якому діє компанія. Нефінансові показники відображають інформацію про операційне середовище, бізнес-процеси та результати діяльності компаній. Китайські вчені запропонували визначення, засноване на особливому ставленні, грошовому потоці та банкрутстві. Китайська комісія з регулювання цінних паперів (CSRC) запровадила систему спеціального підходу (ST) для компаній, що котируються на ринку, з фінансовими проблемами та проблемами оперативного управління. Більшість китайських вчених використовують ST як знак того, що перелічені компанії потрапляють у фінансові труднощі. На підставі досліджень грошових потоків, недостатня платоспроможність компанії, як правило, складається з двох форм: відсутність існуючого та недостатнього потоку грошових коштів. Виходячи з визначення банкрутства, фінансове лихо є серйозним збитком і не може погасити заборгованість. Західні вчені часто використовують статистичний аналіз фінансових коефіцієнтів та даних фінансових звітів, а також використовуються методи кількісного аналізу. Китайські вчені мають більше аналізу з теоретичної точки зору, а кількість емпіричних досліджень відносно невелика. Метод штучного інтелекту є більш абстрактним у класифікації фінансових труднощів, хоча точність висока, втім прозорість такого методу низька. Детальна класифікація фінансових показників, а потім застосування методів штучного інтелекту для класифікації є можливим способом підвищення прозорості методів штучного інтелекту. Автор стверджує, що для підвищення прозорості прогнозування фінансових розладів на основі штучного інтелекту необхідно побудувати більш прозору модель прогнозування. По-перше, фінансова ситуація розбивається на кілька рівнів на основі фінансових та не фінансових показників. Потім встановлюється модель прогнозування на основі даних фінансових звітів, показників грошових потоків, корпоративного управління, макроекономічних показників та інших факторів. Нарешті, на останньому етапі слід вибрати відповідний алгоритм штучного інтелекту для прогнозування.

Ключові слова: *фінансове лихо, визначення, перелічені компанії, біржі, банкрутство, грошовий потік, порівняння.*

Introduction. Financial distress refers to the deterioration of the company's financial situation and the inability to repay debts on time. Bankruptcy is its most serious situation. If the company is in financial distress, it needs to make business adjustments, strategic adjustments, and even seek acquisition and bankruptcy protection.

Listed companies absorb a large amount of investors' funds around the world, and they usually have a large number of stakeholders. For shareholders, investors, management, employees, and other stakeholders, it is valuable to accurately predict the economic status of listed companies, which can effectively reduce the losses of stakeholders. In recent decades, the prediction of financial status, especially for financial distress, has been a hot topic in corporate economic research.

With the development of statistical theory and methods, more and more predictive models and algorithms have been proposed to continuously improve the accuracy and practicability of financial distress prediction. Due to different research purposes, the definition of financial distress exists in the scope and perspective. This paper uses the comparative research method to sort out the definition of financial distress by Western scholars and Chinese scholars and provides a new perspective for the financial status and financial distress prediction of listed companies.

Definition by Western scholars.

2.1. Based on bankruptcy. Alaka et al. used «bankruptcy», «insolvency», «failure», and «default» as the consent words for financial distress, which is a general definition of financial dilemmas in Western scholars' research [1].

Beaver defined «the inability to pay dividends on preferred stocks, the liquidity of corporate bonds, and the inability of companies to pay bank principals and interest» as financial distress [2]. He used the Univariate Discriminant Analysis (UDA) method to predict financial distress. Altman proposed Multivariate Discriminant Analysis (MDA) to predict the company's financial status by calculating Z-Score [3]. This approach extends the definition of financial distress and divides the company into different financial situations through different Z-Scores.

Gordon pointed out that when a company fails or is reorganized, it is already in financial distress, so financial distress should occur first [4]. Deakin defines companies that have gone bankrupt and are unable to perform solvency as a company with financial distress [5]. Lau extended the concept of financial distress. He proposed that financial distress is a gradual process. In this process, financial status can be divided into: 0) good financial status; 1) reduced or unable to pay dividends; 2) unable to repay debts on time; 3) entering bankruptcy protection; 4) entering statutory bankruptcy proceedings. Companies in situation 1) to 4) are considered as financial distress companies [6].

The definition of bankruptcy is the initial stage of the financial distress study in Western countries. With the expansion of the disclosure scope of listed companies' operating data, financial definitions of other perspectives have begun to emerge.

2.2. Based on cash flow. Blum constructed a cash flow model based on three kinds of indicators: liquidity, profitability, and variability [7]. According to this model, the probability of financial distress in the company increases as liquid assets decrease, operating expenses increase, abnormal changes in liquidity inflows and outflows occur, and the industry is in recession. Based on the cash flow model, Aziz, Emanuel, and Lawson proposed that the value of the company comes from the sum of the present value of the cash flow of the operator, creditors, shareholders, and government [8]. They found there was a significant difference in the average value of operating cash flow and cash payment between the bankrupt company and the non-bankrupt company before bankruptcy occurs 1-5 years. John, Whitaker defines financial distress as the company's current assets do not meet the cash needs of its written contract [9; 10].

Based on the definition of cash flow, the financial distress is studied from a dynamic perspective, and the transparency is higher than that of the method using only financial ratio, and the prediction accuracy is also improved.

2.3. Based on non-financial indicators. Flagg proposed that going concern qualifications plays an important role in bankruptcy prediction [11]. Charitou and Trigeorgis built an option-pricing financial distress prediction model. They conducted a comparative test of 139 US companies from 1983 to 1994 and found that primary option-motivated variables were effective in bankruptcy predictions within 1-3 years [12]. Coats and Fant used the audit opinion of CPAs as a definition of the company's financial distress [13].

Non-financial indicators reflect information about the operating environment, business processes, and outcomes of listed companies, and they also provide important information for the financial situation prediction. By establishing a predictive model in combination with non-financial indicators, we can find more details about the company's financial situation and improve the accuracy of the financial situation prediction.

Definition by Chinese scholars.

3.1. Based on Special Treatment. Since 1998, the China Securities Regulatory Commission (CSRC) has implemented a special treatment (ST) system for the listed companies with financial problems and operational management problems. This is a system that alerts stockholders to investment risks. ST is public information, most Chinese scholars use ST as a sign that listed companies are in financial distress [14].

According to the latest listing rules revised in 2018, Chinese listed companies will be marked as special treatment if they have one of the following six

conditions (these conditions are related to the financial situation):

1) The net profit in the last 2 years is continuously negative.

2) The net assets in the last year are negative.

3) The operating income in the last year is less than 10 million CNY.

4) The financial accounting report of the most recent year has been issued by the accounting firm and cannot express opinions or negative opinions.

5) There are major errors or false records in the financial accounting report, which have not been corrected within the prescribed time limit, and the stock has been suspended for two months.

6) The annual report or the interim report was not released on time, and the stock was suspended for two months.

The ST-based financial distress definition is easy to operate but provides less detail. Therefore, other researchers have proposed different definitions, including: definition based on bankruptcy and definition based on cash flow.

3.2. Based on cash flow. Li proposed that financial distress is a financial manifestation of various internal and external contradictions in the company's business process, which is usually manifested by insufficient solvency [15]. Insufficient solvency generally consists of two forms: a lack of existing and insufficient flow. Insufficient existing refers to the company's asset value is lower than the liability value; insufficient flow refers to the company's operating cash flow is insufficient to repay the existing debt due. Lu uses the current ratio to define financial distress and proposes three signs of financial distress: 1) net realizable value is less than the debt due; 2) current assets in the balance sheet are less than current liabilities; 3) cash outflows are much larger than Cash inflow [16]. Li proposed that when the company's cash flow cannot meet the normal payment needs, it is in financial distress [17].

3.3. Based on bankruptcy. Wu and Huang used the provisions of the Enterprise Bankruptcy Law of the People's Republic of China (1986) to define the financial distress as a serious loss and the inability to repay debts due [18]. Gu and Liu define financial distress as: technical fund management failure and bankruptcy, and any situation between these two situations [19]. They proposed that management failure is slight financial distress, and bankruptcy is the most serious financial distress.

Wang and Yang proposed that financial distress can be divided into three levels: 1) failure, investment return rate is obvious and continues to be lower than a similar investment in the market; 2) unable to pay debts on time; 3) bankruptcy [20]. Sun and Qiu divided the financial distress into two situations: technical bankruptcy, which means that although the company's total assets are greater than liabilities, the assets are not properly distributed, it is unable to repay the debts on time; financial bankruptcy means that the company's total assets are less than the total liabilities [21].

The financial distress of listed companies is a gradual process. If management responds through appropriate financial and management strategies, financial distress may be overcome to avoid bankruptcy. At present, there are strict restrictions on initial public offering (IPO) in China, and the stock exchange also limits the number of listed companies. Therefore, financial failure listed companies are usually acquired by companies that wish to go public, which leads to a very small number of bankrupt companies listed in China. With the completion of the CSRC listing rules, the bankruptcy of financially failed listed companies in accordance with legal procedures will become a normal situation.

The abovementioned research by Chinese scholars provides different perspectives for the definition of financial distress of listed companies, which is conducive to in-depth research on this issue.

Conclusion and future research recommendations.

4.1. Similarities and differences between Western and Chinese studies. Western scholars often use bankruptcy as a mark of financial distress, and Chinese scholars often use ST as a mark of financial distress. Although these methods are easy to operate, they do not have a detailed classification of financial conditions, which is not conducive to the detailed prediction of the company's financial situation. Western scholars often use statistical analysis of financial ratios and financial statement data, and quantitative analysis methods are used more. Chinese scholars have more deductions from the theoretical perspective, and the number of empirical studies is relatively small.

Table 1

Comparison between China and Western Scholars

	Western Countries	**China**
Definitions based on	Bankruptcy Cash flow Non-financial statement data	Special treatment Cash flow Bankruptcy
Most used mark	Bankruptcy	Special treatment
Research feature	Quantitative analysis	Theoretical study

4.2. New trends in Financial Distress Prediction. With the development of artificial intelligence algorithms, Chinese and Western scholars have begun to classify financial conditions through artificial intelligence methods in recent years and make predictions based on them. Alaka et al. summarized the accuracy of financial distress prediction and found that the artificial intelligence method has the highest accuracy [22].

Table 2

Comparison of the accuracy of traditional and Artificial Intelligence methods

	Lowest Accuracy	Highest Accuracy
Traditional Methods		
Multivariate Discriminant Analysis	51.3%	91.44%
Logistic Regression	54.4%	92.01%
Artificial Intelligence Methods		
Neural Networks	67.8%	94.03%
Support Vector Machine	69.5%	95.95%

The artificial intelligence method is more abstract in the classification of financial distress, although the accuracy is high, the transparency is low. A detailed classification of financial conditions and then the application of artificial intelligence methods for classification is a possible way to improve the transparency of artificial intelligence methods.

4.3. New ideas for improving the transparency of Financial Distress Prediction.

Although the artificial intelligence method has high accuracy in financial distress prediction, due to the low transparency of the calculation process, it is impossible to provide detailed decision-making information for business owners, partners, and governments. To improve the transparency of financial distress prediction based on artificial intelligence, it is necessary to build a more transparent prediction model. First, the financial situation is broken down into multiple levels based on financial and non-financial indicator data. Then, establish a prediction model based on financial statement data, cash flow indicators, corporate governance, macroeconomic indicators, and other factors. Finally, choose the appropriate artificial intelligence algorithm for prediction.

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