The Problem of Bankruptcy in Listed Companies*

Waldemar Tarczyński[1], Malgorzata Tarczynska-Luniewska[2],
Kinga Flaga-Gieruszynska[3]

Abstarct:

Purpose: The paper presents an investigation of the bankruptcy of companies listed on the Warsaw Stock Exchange using the Fundamental Power Index in dynamic terms (FPI).
Design/Methodology/Approach: The methodology of the Fundamental Power Index (FPI) was used to assess bankruptcy. In general, the essence of the indicator is a synthetic assessment of the company's fundamental strength. The indicator can take high and low values. The appearance of low levels of the ratio for the company is not favourable and indicates a problem in the financial standing area. As a consequence, the level of the ratio may signal a risk of bankruptcy. The article also discusses the legal grounds for bankruptcy of companies in Poland and selected EU countries.
Findings: The results of the conducted research indicate that FPI may be a useful tool of early warning against bankruptcy. The dynamic approach to the index allowed for the assessment of the fundamental strength of the companies in the period of five years. At the same time, the level of the index indicated the risk of bankruptcy. The basis for the construction of the ratio was the financial data from the financial statements of the examined entities. In particular, information on financial ratios from the following groups was used: liquidity, profitability, debt and operational efficiency.
Practical Implications: The implementation of the indicator concerns many areas, including investing, assessment of companies or the stock market. In the event of bankruptcy, information about the level of the ratio may support the management process of the company and early response of managers to avoid bankruptcy (e.g. by introducing recovery or restructuring programs). For the investor, the information about the low level of the ratio is a signal for actions related to risk management.
Originality/Value: The results of the study reflect the applicability and effectiveness of the proposed indicator. Consequently, the fundamental strength index may constitute an alternative to the existing methods of assessing the bankruptcy process in enterprises.

Keywords: Bankruptcy, FPI index, economic and law aspects of bankruptcy.

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[1]*Institute of Economic and Finance, University of Szczecin.*
E-mail: waldemar.tarczynski@usz.edu.pl
[2]*Corresponding Author, Institute of Economic and Finance, University of Szczecin.*
E-mail: malgorzata.tarczynska@usz.edu.pl
[3]*Institute of Law Science, University of Szczecin.*
Email: kinga.flaga-gieruszynska@usz.edu.pl

1. Introduction

Business bankruptcies are a natural element in an economic market economy. In times of crises or recession, it is observed that defaults or bankruptcy proceedings increase. Bankruptcy should be described as a process that results, among other things, from bad effects of the company's activity on the market, bad management, use of assets or capital. Bankruptcy is often a consequence of the lack of reaction on the part of managers and the lack of implementation of corrective and restructuring programs or actions related to it. In the field of bankruptcy, it is important to identify the areas and factors responsible for initiating the bankruptcy process. It will be linked to management reading of signals related to existing threats to the enterprise functioning and its activity on the market (Kourtis *et al.,* 2019). The assessment of signals from the area of situational, sectoral and financial analysis of the enterprise becomes an important issue. Helpful in this respect is, for example, the opinion of the statutory auditor regarding the risk assessment of the company's going concern. Information from financial reporting is important. On the other hand, in the evaluation of market performance, signals concerning the market position and market share are key. It may translate, for example, into the observation of the sales volume of products, the use of services provided by an economic entity.

In the literature, there are many models for forecasting the bankruptcy of an enterprise or its survival. These models were created to verify and assess the threat to the functioning of the enterprise. Models of bankruptcy or bankruptcy threats are used, e.g. in the event of mergers, acquisitions and investments. The task of this type of models is a mathematical and synthetic approach to economic and financial information for the description of the bankruptcy process. An important element is also establishing a recommendation regarding the risk of bankruptcy. Bankruptcy risk ratings based on models are popular in this respect. Various financial institutions share an interest in bankruptcy forecasting models. It is important to assess the risk of actions taken by these institutions. For entities operating within the capital market (e.g. investment funds), verification of the risk of company bankruptcy involves the risk of investing in its securities (e.g. shares of listed companies). Banks, for example, verify and assess the financial situation of an enterprise as a borrower (Witkowska and Kamiński 2005; Witkowska 2006). In this case, credit risk becomes a key factor (Curtis *et al.,* 2020).

In the literature there exists many models for forecasting the bankruptcy of a company or the risk of bankruptcy. The precursor of this type of models was Altman (1968), who, using the discriminant function, created a bankruptcy risk model taking into account selected financial indicators. The procedure developed by Altman generally boils down to the determination of the Z index. This model is also known as the Z-score model. Determining the Z index allows for inferring with high probability whether the company is at risk of bankruptcy. The Altman model is a simple tool to estimate and interpret. Unfortunately, it also has limitations resulting from the basics of its construction. Altman focused on building the model on listed

companies from the American market. It may not be useful to apply the model to other markets and companies. It should be emphasized, that research on the Z-score model allowed for its numerous modifications, e.g. the Z-score model for companies from the emergin market. Research on the second generation of the model presented in (Altman, Haldeman, and Narayanan, 1977) is noteworthy. The model evolved, which was presented in the next modification of the model (Altman 2000).

Researchers have considered the issue of bankruptcy for many years, which was reflected in many works related to it (Keasey and Mcguinness, 1990; McKee, 2000; Wędzki, 2005; Pan 2012; Charitou *et al.,* 2015). The process of bankruptcy or insolvency of enterprises can also be associated with the analysis of the survival of companies, e.g. in the works of Markowicz and Stolorz (2006). The considerations show that there is no single model for forecasting the bankruptcy of a company or its survival. New solutions or constructed tools in this area are still being sought. The article proposes the use of a multi-dimensional approach to bankruptcy assessment.

The paper presents an investigation of the bankruptcy of companies listed on the Warsaw Stock Exchange using the Fundamental Power Index in dynamic terms (FPI). The article also refers to the legal aspects related to the issues of bankruptcy and insolvency. The paper is structured as follows: Section 1 is the introduction to the issue of bankruptcy, section 2 presents basic economic aspects in bankruptcy process, section 3 refers to law aspects in bankrupty (in Polish law and select UE countries), section 4 is a short description of the method (FPI index) and data, section 5 shows the main results of the study, and section 6 covers the conclusions.

2. Basic Economic Aspects in Bankruptcy

A key element in assessing the bankruptcy process is paying attention to information from the area of situational and sectoral analysis as well as financial analysis (Tinoco and Wilson, 2013; Tian and Yu. 2017). In addition to macroeconomic information, early warning systems include microeconomic information from the enterprise level. The first type of information concerns the sphere of the company's operation. Important are internal and external factors. Information related to the analysis and evaluation of the company in a given sector or market becomes crucial. The company's development prospects are taken into account from the point of view of non-financial factors, e.g. such as product specificity (including its attractiveness), information flow and management efficiency, technique and technology used, or HR policy. A significant element is the assessment of competitiveness factors. The situational and sectoral analysis is qualified for qualitative evaluations. However, it is an area that provides much important information that may constitute important signals of emerging threats to the efficient functioning of the enterprise. Ignoring these signals can lead to bankruptcy as a consequence (Thalassinos and Stamatopoulos, 2015; Thalassinos *et al.,* 2015).

The second group of information concerns information in the area of financial analysis. It should be noted that many bankruptcy procedures and models use economic and financial ratios to determine the analysis and use of the company's financial statements. In this respect, economic and financial indicators become keys, which can be divided into five groups as in the work of Sierpińska and Jachna (1993): 1. liquidity ratios, 2. activities ratios, 3. debt indicators, 4. profitability ratios, 5. market ratios (determined only for companies listed on the stock exchange).

In bankruptcy forecasting models, ratios from these groups are important predictors. In historical terms, it was presented in Pociecha (2014). In contemporary research, apart from the indicators already mentioned, one can find such measures as (Table 1).

Table 1. *The type of financial ration*

The type of ratio

cash flow/total liabilities	rotation commitments in days
working capital/total assets	receivables turnover in days
retained earnings/total assets	rotation of assets
EBIT/total assets	inventory turnover
market value of equity / book value of total liabilities	the operating cycle
eevenue from sales / total assets	rate of assets
efficiency of assets	gross profit margin
net profit margin	debt ratio
liquidity ratio	assets ratio

Source: *Sierpińska, Jachna 1993 and Wedzki 2005.*

The role and importance of information from the area of financial standing assessment of a company become crucial in practice (Liang, Lu, Tsai, and Shih, 2016; Halpern, Kieschnick, and Rotenberg 2009). The selection of specific measures becomes a very important element that determines the effectiveness of models and procedures for bankruptcy analysis. In this context, the assessment of the quality of economic and financial data is of great importance. There is no doubt that the financial liquidity ratios play a special role as they enable the assessment of the level of fulfilment of current liabilities (Ugurlu *et al.,* 2014). In the investigation of bankruptcy risk, the ratios of the structure of financing the company's assets should be mentioned in the second place. Activity ratios should complement the analysis. These are all basic current assets rotation ratios. Profitability ratios are the clamps linking the index assessment of the enterprise. In practice, regardless of the approach and method, economic and financial indicators in the presented hierarchy of importance should be used in analyzes and bankruptcy forecasting models.

3. Law Aspects of Bankruptcy

The Polish legal system introduced the "second chance" rule, the essence of which is the primacy of restructuring proceedings over bankruptcy proceedings, and thus the

legislator's striving to keep the debtor as a participant in economic transactions. When focusing on the aspects relating to the economic situation of the company, it should be pointed out that the premises for opening restructuring proceedings – apart from formal requirements omitted in this analysis – are: 1) insolvency (Art. 6 paragraph 1 of the Restructuring Law) [Act of 15 May 2015]; 2) threat of insolvency (Art. 6 paragraph 1 of the RL); 3) making the ability to meet costs and liabilities more probable (Art. 8 paragraph 2 of the RL).

The concept of insolvency is the same in the case of restructuring and bankruptcy proceedings. According to Art. 11 of the BL [Act of 28 February 2003], a debtor is insolvent if they have lost the ability to meet their due pecuniary obligations. Due to the interpretation difficulties that have arisen in the jurisprudence, a legislative instrument in the form of a rebuttable presumption concerning this premise has been introduced. It is presumed that the debtor has lost the ability to meet their due pecuniary obligations if the delay in the performance of pecuniary obligations exceeds three months. At the same time, a debtor who is a legal person or an organizational unit without legal personality, to which a separate act grants legal capacity, is insolvent also when their pecuniary obligations exceed the value of their property, and this condition persists for a period exceeding twenty-four months. The property subject to this assessment do not include properties that are not part of the bankruptcy estate.

However, the indicated pecuniary obligations do not include future obligations, including obligations subject to the condition precedent, and obligations to a partner or shareholder under a loan or other legal transaction with similar effects, in particular the delivery of goods with deferred payment, made to the bankrupt being a capital company during the five years period prior to bankruptcy, plus interest. In this regard, the legislator also used a rebuttable presumption, according to which it is presumed that the debtor's pecuniary obligations exceed the value of their property if, according to the balance sheet of their obligations, excluding provisions for obligations and obligations towards related entities, they exceed the value of their assets, and this state is maintained for a period exceeding twenty-four months (Art. 11 paragraph 5 of the BL). On the other hand, when speaking about the threat of insolvency, it should be considered that this term refers to the risk of the debtor losing the ability to meet their due pecuniary obligations in a short period of time.

These structures are similar to the solutions used in other European countries. In this case, the legislator also aims to satisfy the creditors, taking into account, however, the possibility of maintaining the debtor as an entrepreneur.

The German insolvency law (Insolvenzordnung [Insolvenzordung 1994] – hereinafter referred to as InsO) provides for the following reasons for initiating recovery proceedings or declaring bankruptcy: insolvency, threat of insolvency and over-indebtedness (Closset and Urban, 2019). Insolvency occurs when the debtor is unable to meet their due pecuniary obligations (§ 17 paragraph 2 of InsO). On the other

hand, the threat of insolvency arises when the debtor is most likely not able to pay the existing obligations as they fall due (§ 18 of InsO). Over-indebtedness occurs when the debtor's property does not cover the existing obligations, unless it is predominantly probable that they will continue to operate their business under the circumstances (§ 19 paragraph 2 of InsO). This definition requires the examination of two basic elements, i.e. numerical over-indebtedness, and the forecasts for the continuation of business activities (Eger, 2005). The task of the court is to distinguish whether the debtor's problems with meeting the obligations due are periodic or permanent (judgment of BGH 2005). Due to the level of complexity and cost-effectiveness of the discussed proceedings, the triviality criterion is introduced, as a result of which the debtor's insolvency cannot be assumed when the financial deficiencies amount to less than 10%. The date of loss of financial liquidity is determined using the balance of payments, which compares obligations with the debtor's available cash. However, it is enough if one obligation is not met (Hofman, 2014).

On the other hand, the French legislator – as a result of numerous criticisms of the regulations in force (Pietracosta and Vermeille 2020) – extended preventive actions in the field of declaring bankruptcy, introducing a whole range of procedures (including out-of-court procedures) aimed at avoiding the debtor's bankruptcy (Plantin, Thesmar, and Tirole 2014). The protective proceedings are initiated when the debtor experiences difficulties which they are unable to overcome but the payments have not yet ceased. The more extensive and rigorous recovery proceedings are initiated if the debtor is unable to meet their current obligations from available assets and has stopped making payments to creditors. The purpose of recovery proceedings is to maintain business activity and jobs, and to settle the obligations (Rotaru, 2019). Finally, liquidation proceedings, treated as a last resort, are initiated when the entrepreneur has stopped making payments and when it is obvious that it will not be possible to carry out recovery proceedings.

In the case of the Spanish legislator, the condition for declaring bankruptcy is also objective in nature (Aguiar-Díaz and Ruiz-Mallorquí, 2015), because in this case it is also the debtor's insolvency, understood as the inability to meet their obligations on a regular basis (Galán González and Ariza Colmenarejo, 2010). The bankruptcy proceedings may also be opened in a situation where the debtor anticipates their insolvency in the future (Act 22/2003), which is a solution similar to the idea of the Polish restructuring procedure (Gurrea Martínez, 2018).

Consequently, it can be assumed that insolvency – in the case of public companies also perceived as a situation in which the value of pecuniary obligations exceeds the value of the debtor's property – is the basic criterion for opening bankruptcy proceedings.

4. Data and FPI Index

The formal construction of the Fundamental Power Index (*FPI*) (the full procedure is presented in (Tarczyńska-Łuniewska, 2013). It is a multidimensional measure that captures the effect of the impact and relationship of financial indicators. It should be noted that multidimensional measures have found many It is a multidimensional measure that captures the impact of the influence and relationship of financial indicators. It should be noted that multidimensional measures have found many applications in the assessment of economic phenomena, e.g. for the construction of aggregate measures (Nermend, 2012) or capital market analyzes (Al-Augby, Majewski, Nermend, and Majewska 2014) applications in the assessment of economic phenomena, e.g., for the construction of aggregate measures (Nermend, 2012) or capital market analyzes (Al-Augby, Majewski, Nermend, and Majewska, 2014). Dynamic fundamental power index, fundamentally stable, has been applied in this study, considering only quantitative factors, which may be presented as follows:

$$FPI_j = FS_j = \sum_{i=1}^{k} \sum_{t=1}^{n} w_t \cdot FS_{ij},$$

$$w_t = \frac{nc_{it}}{N}, \tag{1}$$

$$\sum_{i=1}^{n} w_t = 1, \quad w_t \geq 0, \text{ for } i = 1,2, ...,k; t = 1,2, ...,n;$$

where:
w_t – weight for *i*-factor over *t* -period,
nc_{it} – number (sequence) of *i*- quantitative factor over the period *t* ,
N – number of sequence of *i*- factors over the studied period ($t = 1,2, ...,n$),
k – number of all fundamental factors,
$FS_{...t}$ – measure of fundamental power over *t* period (in the studu were used sum of all scores for all factors according to Table 1).

Table 1 includes scores allocated to economic and financial indices used in the study. Most of them have general standards, commonly adopted or sector standards. For all companies subject to analysis scores can be also determined under statistical analysis of economic and financial indices. In terms of fundamental strength and development prospects over long- term investment the higher is *FPI* level the company is better.

Table 2. *Scores allocated to the selected economic and financial indices*

Index	Standard values	Scores	Max number of points
Current ratio	<1,2;2>	below 1,2 – 0 pts <1,2 to 1,4) – 3 pts <1,4 to 1,6) – 4 pts <1,6 to 2) – 6 pts over 2-4 scores	6
Liabilities rotation in days	<30;60> (days)	below 30 – 6 pts <30 to 40) – 4 pts <40 to 50) – 3 pts	6

		<50 to 60) – 2 pts over 60-4 pts	
Receivables rotation in days	<30;60> (days)	below 30 – 6 pts <30 to 40) – 4 pts <40 to 50) – 3 pts <50 to 60) – 2 pts over 60-4 pts	6
ROA	0	<0 to 0.2) – 2 pts <0.2 to 0.4) – 4 pts over 0.4-4 pts	6
ROE	0	<0 to 0.2) – 2 scores <0.2 to 0.4) – 4 pts over 0.4-4 pts	6
Debt ratio	<0.5;0.9>	below 0.5 – 6 pts <0,51 - 0,6> – 5 pts <0,61 - 0,7> – 4 pts <0,71 to 0,8) – 3 pts <0,81 - 0,9> – 1 pts over 0.9-4 pts	6

Source: *Own elaboration (Tarczyńska-Łuniewska, 2013 p. 227).*

Table 2 shows that a given company may reach maximum 36 scores. Table 3 presents assigned levels of the company's fundamental strength (FS level) and bankruptcy threat recommendation (Recommendation).

Table 3. *Intervals of FPI classification by points.*

Max 36		*FS* level	*Recommendation of FPI*
36.00	27.00	high/strong	no threat
27.00	18.00	good	no threat in short term
18.00	9.00	low	potentialy threat in the short term
9.00	0.00	very low	threat

Source: *Own elaboration.*

The bankruptcy threat study was conducted for companies listed on the Warsaw Stock Exchange. The analysis covered the years 2006-2018. The research was divided into two stages: 1. the years 2006-2014, where the study covered 203 companies from the main market. First, the FPI index in dynamic terms was determined for companies. The index covered years 2006-2010. In the next four years, it was observed which of the companies went bankrupt. The study took into account both the level of the indicator and its recommendation regarding the risk of bankruptcy. 2. the years 2010-2018, where the research was carried out for companies in the period 2014-2018, declared bankruptcy. The FPI index for years 2010-2013 was checked in case of its level and bankruptcy threat recommendation for companies. An important element was the comparison of the index recommendation with the actual state of bankruptcy.

The study used financial data in the field of 1. Profitability (ROA, ROE); 2. Liquidity ratio (Current Ratio); 3. Activity Ratio: (Receivables Turnover in days, Rotation commitments in days, Rotation of Assets); 4. Debt Ratios (Debt Margin).

5. Empirical Results

The results of the study are presented in following tables (Table 4, Table 5 and Table 6).

Table 4. *The number of companies according to the accepted division of dynamic* $FPI_{2006/2010}$

Level of FS	Number of companies	Recommendation of FPI
high/strong	0	no threat
good	20	no threat in short term
low	161	potentialy threat in the short term
very low	22	threat

Source: *Own elaboration.*

The results presented in Table 4 indicate that out of all the 203 companies surveyed, 183 (90.1%) can be considered companies with weak fundamental strength. These companies are also classified as endangered (10.8%) or potentially at risk of bankruptcy (79.3%).

Table 5. *Recommendation of the FPI index and year of bankruptcy*

Year of Bankruptcy by Liquidation	Company	Level of $FPI_{2006/2010}$	Recommendation of $FPI_{2006/2010}$
2011	ORZEL	18.00	potential threat in the short term
2012	JAGO	9.13	potential threat in the short term
	VISTULA	14.00	
	PBG	13.47	
	DUDA	12.60	
	DREWEX	10.80	
2013	BOMI	16.33	potential threat in the short term
	PLJADLO	12.27	
2014	ENERGOPL	14.00	potential threat in the short term

Source: *Own elaboration.*

The data in Table 5 show that nine companies (4.4%) declared bankruptcy in the subsequent years of 2011-2014. All these companies had a recommendation of the indicator "potential threat in the short term.".

Table 6. *Recommendation of the FPI index and year of bankruptcy for selected companies*

Year of Bankruptcy	Company	FPI$_{2010/2013}$	Recommendation of FPI
2014	ENERGOPL	2,90	threat
	GREENECO	4,80	
2015	ONE2ONE	2,00	threat
	DSS	2,40	
	ADVADIS	3,00	
	EUIMPLANT	3,00	
	PBOANIOLA	6,50	
	GANT	7,90	
2016	EFH	7,60	threat
	EKANCLEAR	18,50	no threat in short term
2017	TOPMEDICA	14,60	potential threat in the short term
	BACD	21,60	no threat in short term
2018	MINI	8,00	threat
	FOTA	9,00	
	PETROLINVEST	9,60	potential threat in the short term
	ALMA	14,70	

Source: *Own elaboration.*

The analysis of the data in Table 6 shows that the fundamental strength of the companies that filed for bankruptcy was very low. 64.7% of the surveyed companies had a recommendation of the fundamental strength index as a threat of bankruptcy. Two of the surveyed companies (EKANCLEAR and BACD) did not have a negative recommendation, but they did not cope with the market situation.

6. Conclusions

In the analyzed period of 2006-2010, listed companies are diversified in terms of dynamic FPI. The large differentiation is also the effect of the different sensitivity of the analyzed companies to the crisis that took place in the analyzed period. Evidently, companies in sectors that were more severely hit by the crisis experienced worse levels of dynamic FPI.

The average fundamental strength of listed companies is low. Companies that declared bankruptcy (2014-2018) also had very little or no fundamental strength. The levels of the FPI2010-2013 indicator confirm this. It means that empirical data confirmed the assumption that the FPI could be used to assess the risk of bankruptcy.

Management of the company can use the FPI index as a warning signal in the case of bankruptcy threat or insolvency. It is important to develop a benchmarking system that enables companies to classified them into different groups risk of the distress or bankruptcy threat. The proposed method could be helpful in the process of company management, including the monitoring of changes in the area of financial results. It is also important that the proposed method enables automatic evaluation of the companies and easy introduction of new data. In practice, information on the stability of financial indicators in time should be used in the assessment of fundamental strength.

An important element that should also be taken into account is the legal aspects related to the bankruptcy process. The combined approach to the legal and economic aspects of bankruptcy allows for a comprehensive assessment of this phenomenon. The research results presented in the article encourage the development of this method and its application in practice by investors and managers of individual companies.

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