Application of Business Crisis Forecasting Models in Bulgaria

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Abstract. Every business organization faces a crisis at a certain point in its development. Crisis phenomena for overcoming preventive measures can lead to serious economic and social problems for the organization or its bankruptcy. The crisis is a widely held view and its indications affect different aspects of the financial, social, spirit life of the nation. It’s important to accent not only to the consequences of its manifestation but also to the opportunities for overcoming. This study focuses to analyze the specific models for assessing the dangers of crisis in Bulgarian enterprises. The report aims to systemize the methods and models for assessing the crisis in the enterprises from different sectors of the Bulgarian economy and to define the specific influential factors on them. A questionnaire was used to collect data from a sample of 312 enterprises which were selected through stratified random sampling method. Collected data were analyzed using descriptive and inferential statistics with the aid of Statistical Package for Social Sciences (SPSS). The study revealed that in the food industry is used Altman's five-factor Z-score while in the enterprises from the financial sector, telecommunications and the IT sector the Springate model is used. Tourism businesses, those in the education sector, and chemical and health enterprises prefer to predict crises through Toffler's model. The results show that crises are somewhat the driving force behind the creation of innovation and are a prerequisite for the emergence of modern forms of entrepreneurship so necessary to stabilize the economic system.

1. Introduction

Crisis phenomena for overcoming preventive measures can lead to serious economic and social problems for the organization or its bankruptcy. Business crises occur at different intervals, provoked by a number of factors, characterized by different scales and forms of manifestation, and have the ability to repeat, i.e. have a cyclical character.

The development of the world economy, including the Bulgarian economy [1], [2], [3], is still under the impact of the global economic crisis. Since 2009, they have had a strong impact on the dynamics of the development of the industrial sector and its companies and enterprises in Bulgaria [4], [5]. Objective was the deterioration of most business performance indicators, a sharp decline in innovation and foreign investment in our economy due to loss of interest and incentives, the high...
degree of uncertainty and risk in its development [6], [7]. These crisis circumstances increase the interest of researchers and scientists in revealing the genesis, prerequisites and trends in the global economic and financial crisis in the national economies and its impact, especially in the industrial sector, businesses and enterprises [3], [4].

The main purpose of the study is to analyze the theory in the sphere of anti-crisis management to systematize the indicators, models and methods for crisis forecasting in the Bulgarian enterprises from the different branches of the economy.

The objective is decomposed into the following research tasks:

First, revealing the peculiarities and causes of company crises, the types of crises and the factors for their development.

Secondly, on the basis of a critical analysis of research, to develop the principles, approaches and concepts of anti-crisis management of industrial enterprises.

The object of research is 312 enterprises, representing all sectors of the Bulgarian economy.

The subject matter of the study is the specific models for anti-crisis management, in the context of the real opportunities for introducing strategic innovations as a factor for achieving efficiency and competitiveness in the long-term perspective.

The research supports the main research hypotheses, namely that the concept of crisis can not be unified, because of the many areas in society, which is manifested. The systematization of factors generating crisis development in enterprises shows that external factors have an impact on the formation of their competitive environment, and internal factors affect their management, but regardless of whether they are internal or external they have a constructive or negative influence on their development.

In the present study, the following methods were used: analysis and synthesis; induction and deduction; analogy and comparisons; quantitative methods, by statistical processing of SPSS (one-dimensional, two-dimensional distributions, $\chi^2$-square and correlation coefficient).

Data and information from NSI, SAPI, Agrostatistics Department at The Ministry of Agriculture and Food, Marketing and Market Research Agency ICAP, EUROSTAT and others were collected, analyzed and synthesized. Studies, strategies, outcomes and guidelines of work from national and regional programs have been used. In the development of the analysis, results of the Association of Meat Processors in Bulgaria and the Association of Industrial Capital in Bulgaria surveys, as well as similar surveys and relevant information sources on the subject of analysis were used.

Literature Review

Every business organization faces a crisis at a certain point in its development. The etymology of the term "crisis" is of Greek origin. It is associated with a phenomenon or a set of phenomena, both personal and social, bearing negative changes. Personally, the concept of crisis is identifiable as a stressful state due to health, financial or other reasons. In the public context, the concept is associated with an unstable and dangerous situation caused by economic, political or international problems. The crisis, according to the glossary of foreign words [8], means "acute change, turning, decisive moment, verdict, decision on a question in a questionable situation. "In ancient times, the Greek philosopher Hippocrates considers the crisis limited only to the human organism [9]. In the field of international relations, the "crisis" is related to the emergence and development of conflicts characterized by a threat to basic social values (independence, freedom, etc.). In the economy, as a common feature of economic crises, "there is a shortage of resources for the effective realization of the assigned functions of enterprises, corporations, economic systems, the national economy of the country or the world as a whole" [10].

1.1. The Concept of Business Crisis

Business crises are a common phenomenon and an integral part of their emergence, economic development and liquidation. They start with the onset of the first symptoms of the crisis and continue until its final positive or negative resolution.
Depending on the behavior and performance of a company, the onset of the crisis develops in a typical direction, going through the following phases - strategic crisis, revenue crisis, liquidity crisis and bankruptcy [10]. (see figure 1)

**Strategic crisis.** Also known as the hidden insolvency or latency stage. The strategic crisis does not threaten the enterprise in the present, but in the future. In this state, the enterprise only deals with invisible disproportions. Prerequisites for the emergence of a strategic crisis are changes in consumer behaviour, population structure, market developments, legislation and politics.

![Outcome of the enterprise as a symptom of the crisis](image)

**Figure 1.** Outcome of the enterprise as a symptom of the crisis.

*Source:* Iliev Y., Anti-Crisis Management of Industrial Firms, Avangard Prima, S., 2011, p. 48

From the economic point of view, the first symptoms of the strategic crisis are the decline in business activity, the reduction in sales volumes, the reduction of the prices of the products due to over production or loss of quality, the reduction of production capacity, the loss of markets and, the market position of the enterprise.

Depending on the reasons for the emergence of a strategic crisis, there are different possibilities for reaction - by changing the location of the company, attracting new customers, diversifying own products, merging companies.

**Revenue crisis,** also known as a stage of apparent insolvency, a stage of financial instability or a period of crash. An enterprise is in a revenue crisis when its profits or turnover begin to decline and debt increases. The stage is characterized by the company's inability to perform its cash obligations in full and in full. This is a period in which it begins to experience difficulties for timely payment.

**Crisis of liquidity.** Most often, this is the phase in which a crisis is being talked about, but this is not yet the final stage. The stage is characterized by the fact that the company can not cover its obligations in a timely manner. Creditors are not ready to negotiate, suppliers are only delivering on advance payment. Unless rapid action is taken at this stage, the path to bankruptcy is inevitable.

**Bankruptcy (insolvency).** Bankruptcy characterizes a situation in which an entity is unable to continue to operate in its present form and scale. Bankruptcy has two outcomes:

- **positive** - reorganization of the enterprise through a rehabilitation plan, transformation or business combination with other enterprises and restoration of its activity to a qualitatively new level or in a new legal-organizational form;
• **negative** - termination of the enterprise's activity, liquidation and its complete deletion as a business entity.

According to Argenty J., the most difficult from a technical point of view is the problem of identifying the initial symptoms of the financial crisis due to the creative keeping of companies' accounts [9]. It distinguishes the causes of bankruptcy from symptoms according to three indicators:
  - **financial** - are established using the techniques of financial analysis;
  - **non-financial** - stemming from management, marketing, planning, motivation of staff, etc.;
  - **terminal** - regardless of which stage of the crisis process they are identified, they characterize the final phase of the financial crisis - bankruptcy.

The financial crisis can also be triggered by a suboptimal structure of capital, assets, investment, unbalanced time and money flows, impaired financial sustainability, and so on [4], [7]. It creates the greatest potential threats to the successful operation of the enterprise, and may lead to insolvency [2], [3].

The stage of bankruptcy has far-reaching negative consequences and generates a destructive potential, which is expressed in the fact that:
  • Failing enterprises create serious risks for successful businesses and their partner commercial banks, causing them material damage in the process of business interaction.
  • Failing enterprises complicate the formation of the revenue side of the state budget and extra-budgetary funds, slowing economic and social development programs and worsening the macroeconomic indicators of the national economy.
  • Using the inefficiently allocated credit resources, bankruptcy firms have a downward impact on the overall profit rate and the turnover of capital in their entrepreneurial sphere.
  • Failing companies cut jobs and reduce the number of people employed in public production, where social tensions escalate and the social crisis worsens in society.

The exact establishment of the stage of the crisis process in the enterprise requires a reliable information base that has important practical relevance in determining the real scale and expected consequences, choice of strategy and countermeasures.

1.2. Models for predicting and assessing the dangers of a crisis

The ability to predict an enterprise's insolvency crisis before it arises is important for both its management and creditors. Business insolvency research dates back to the late 1930s in the United States. At the beginning of the twentieth century a number of researchers were dealing with bankruptcy problems. Thus, for example, analyzing 183 companies experiencing financial difficulties between 1921 and 1930, suggest that the most reliable indicator of forthcoming bankruptcy is to reduce the ratio between net working capital and the sum of assets [11].

On the basis of a comparative study of the indicators of 20 bankrupt companies in the period 1920-1929 and the indicators of 19 successful companies during the same period concluded that the two ratios - between profit and equity and between equity and debt are the most reliable indicators to predict the risk of bankruptcy. S. Mervin based on data from 939 companies over a ten-year period, shows the possibility of predicting bankruptcy for 4-5 years until it arrives, through the dynamics of three ratios - to cover interest payments, the ratio between net working capital and the sum of assets, and the relationship between own capital and debt [10].

| Indicator      | Formula                                      | Meaning metric                      |
|----------------|----------------------------------------------|-------------------------------------|
|                |                                               | For successful companies  | 5 years before bankruptcy | 1 year before bankruptcy |
| Bever coefficient | Net profit + Amortization / Liabilities | 0.4 - 0.45 | 0.17 | - 0.15 |
The first attempt to develop a model for predicting insolvency by using financial ratios is by W. Beaver [12]. It compares indicators of 79 insolvent companies with the same indicators in 79 stable enterprises, and finds that five years before the collapse, the difference between the two sets of indicators are significant and there are signs of the on-going crisis. Beaver's model is a ratio that is calculated as the ratio between the amount of cash flow and the total amount of the entity's liabilities. Table 1 presents this coefficient (See Table 1).

In 1972, British economist R. Liss developed a business model in the UK, using indicators of liquidity, profitability and financial independence of the business organization [9], [10]. The model of R. Lys represents the following formula:

\[ Z = 0.063 \times X1 + 0.092 \times X2 + 0.057 \times X3 + 0.001 \times X4, \]  
(1)

where:
- X1 is the Turnover / Asset Amount;
- X2 - Profit before Interest and Taxes / Amount of Assets;
- X3 - Retained earnings / Amount of assets;
- X4 - Equity / Debt.

Interpretation of results:
- \( Z < 0.037 \) - high probability of bankruptcy
- \( Z > 0.037 \) - the probability of bankruptcy is small

The Springate model was built by Gordon Spring in 1978 [13]. The model was built by testing 40 asset companies with an average of $2.5 million. In the process of setting up 19 financial ratios considered to be representative in the final version only four quotes remain on the model. Its general appearance is as follows:

\[ Z = 1.03 \times X1 + 3.07 \times X2 + 0.66 \times X3 + 0.4 \times X4, \]  
(2)

where:
- X1 is the Net Working Capital / Asset Amount;
- X2 - Profit before interest and taxes / Amount of assets;
- X3 - Accounting Profit / Current Liabilities;
- X4 - Net Sales Income / Amount of Assets.

At \( Z < 0.862 \) it is assumed that the company is in poor financial condition and financially difficult; her assessment is "crash".

The advantage of the model are that the model has a good level of predictability. Deficiencies of the model are: There is no sectoral and regional one differentiation, and it is appropriate for use in advanced economies.

The Taffler model for predicting the probability of bankruptcy was proposed in 1977 and is a fourfold forecasting model [14]. It is recommended to take into account the current trends in business and the impact of prospective technologies on the structure of financial indicators. The model is expressed by the formula:

\[ Z = 0.53 \times X1 + 0.13 \times X2 + 0.18 \times X3 + 0.16 \times X4, \]  
(3)

where:
- X1 is Profit before Interest & Tax / Current liabilities;
- X2 - Current Assets / Total Liabilities;
- X3- Current liabilities / Amount of assets;
- X4 - Net Sales Income / Amount of Assets.

Interpretation of results:
- \( Z > 0.3 \) - low probability of bankruptcy;
- \( Z < 0.2 \) - a high probability of bankruptcy.

The advantage of the model is that model parameters are calculated based on the basis of the financial statement, which allows it to be used in external analysis. Deficiencies of the model are: it does not account for sectoral and regional specifics of the enterprise and only at a negative value of \( Z \) it can be claimed that the enterprise is close to bankruptcy.
A significant group of models for predicting the probability of bankruptcy are the Z-models developed by E. Altman [15], [16] often referred to as the "father" of modern theory of bankruptcy forecasting. Altman develops two-factor, five-factor, and seven-factor Z models. The two-factor model has the following features:

\[
Z = -0.3877 - 1.0736 \times K1 + 0.0579 \times K2, \quad (4)
\]

where:
- \(K1\) is a current liquidity ratio;
- \(K2\) - the financial dependency ratio, which represents the relationship between the debt and the balance sheet total of the asset (liability).

**Interpretation of results:**
- \(Z > 0\) - the probability of bankruptcy is over 50% and increases with the increase of \(Z\);
- \(Z = 0\) - the probability of bankruptcy is 50%.

The model is not adequately explained in the literature, and thus is associated with its low popularity and limited use. Its advantage is the ability to be used in a limited amount of information about the enterprise. The drawback of the model is that it does not provide high precision on bankruptcy forecast. It also does not include performance metrics for the resources used.

The most popular is the five-factor model for predicting corporate bankruptcy, known as Altman's Z-Score. The essence of the model is to select relatively independent coefficients and determine their respective weights. When developing the model, E. Altman analyzed 66 companies, half of which went bankrupt in the period 1946-1965, and the other half worked successfully. He has also investigated 22 analytical ratios that can be used to predict the risk of bankruptcy. From these metrics, he selects the five most important for the prognosis and integrates them into the multifactorial regression equation. Variables are classified into the following groups: liquidity, yield, indebtedness, solvency and efficiency. These indicators include Altman in the original five-factor model, which has the following appearance:

\[
Z = 1.2 \times x1 + 1.4 \times x2 + 3.3 \times x3 + 0.6 \times x4 + 0.999 \times x5, \quad (5)
\]

where:
- \(x1\) is the ratio of working capital / amount of all assets. Characterizes the share of working capital in assets.
- \(x2\) - the ratio of undistributed profit / total of all assets. Characterizes the profitability of assets on the basis of undistributed profits.
- \(x3\) - the ratio of profit before interest and taxes / amount of all assets. Shows the profitability of assets based on operating profit.
- \(x4\) - equity value / carrying amount of attracted capital. Characterizes the funding ratio.
- \(x5\) - sales / total income ratio of all assets. Shows the return on all assets.

The coefficient obtained by applying the model allows to determine the probability of an enterprise bankruptcy. For this purpose, Altman formed the following intervals with different probability of bankruptcy:

- \(Z < 1.23\) - financially troubled enterprise, potential bankruptcy (crisis)
- \(1.23 < Z < 2.90\) - uncertainty, area of uncertainty, high probability of bankruptcy in the near 2-3 years (pre-crisis state)
- \(Z > 2.9\) - secure enterprise, there is no risk of bankruptcy (steady state)

Therefore, the result assuming that the undertaking under study is experiencing financial difficulties is \(Z < 2.9\), and the result at which the enterprise is classified as actually going bankrupt is \(Z < 1.23\).

**Advantages of the model** are that the indicators in the model characterize different aspects of the business. **Deficiencies** of the model are: the model is developed on the basis of data from a developed economy. Components of the formula are related to various crises in the enterprise - X1 - with a crisis in management; X4 - with the financial crisis; X2, X3 and X5 - with an economic crisis in the enterprise.
1.3. Exploration

The survey of anti-crisis management models used was conducted between 1.09.2018 and 15.12.2018 among companies of various industries and sizes. The survey is based on open and closed questionnaire. A questionnaire was used to collect data from a sample of 312 entreprises which were selected through stratified random sampling method.

Responding companies are of varying size as staff, with the smallest companies with 1 to 10 employees and more than 500 employees being distributed in a balanced manner (see fig. 2).

![Figure 2. Number of employees](image)

![Figure 3. Distribution of respondents by industry](image)

About 10% of respondents say they have not introduced anti-crisis management. Logically, the smallest companies with a turnover of less than BGN 500,000 have the least use of similar systems, with only 12% of these companies responding with “yes”. An interesting result is that among the companies with sales revenues of over BGN 500,000 there is no relation between the size of the company and the system. Even from companies with over BGN 10 mln turnover for 2018, 68% use anti-crisis management.

![Figure 4. Methods of anti-crisis management used by the industrial sectors](image)

25% of the respondents are representatives of the IT sector, 20% are from Telecommunications, 16% from the food industry, 14% from the financial sector, 11% from education, 5% from tourism, 5% from chemical industry, 2 from medicine % and others - 1% (see fig. 3).

Research has shown that the most preferred method of anti-crunching in the food industry is Altman's Z-Score model (see fig.4). Businesses in the tourism sector and education prefer to use Taffler model. Companies in the financial sector, telecommunications and the IT sector anticipate...
crises with the help of the Springate model. The other two models - the model of R. Lys and the model of W. Beaver - are applied significantly less frequently by some companies from the IT sector, telecommunications, health and finance.

**Conclusion**

From the interpretation of the different strategic options to overcome crises in enterprises, two options for their anti-crisis management can be summarized. According to the first, anti-crisis management is achieved by realizing cost savings of the enterprise and selling surplus assets. According to the second, anti-crisis management is realized through the production and sale of competitive products. Anti-crisis management, aimed at increasing sales and improving economic, financial and social status, is preferable to anti-crisis management leading to cost reductions and the sale of available assets, so the two options are not opposed, as the first one can achieve quick effect and to provide the resource for realization of the second.

The limited time resource for crisis management requires the use of anti-crisis management models that predict a crisis situation that can greatly contribute to the detailed planning of the enterprise's operations and hence the preparation of preliminary decision-making options.

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