

Framework for evaluation risk of bankruptcy for economic entities using specific models and methods from economic analysis and information technologies

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Abstract

Currently, there is greater interest on economic and financial analysis of the firm, due to the feeling of instability caused by the global financial crisis. Simply put, governments, and millions of individuals holding shares in the stock market as small investors were placed in an unprecedented situation. This paper aims to estimate the default risk through the use of IT.

Keywords: financial analysis, business models, knowledge, rate of economic, expert systems

1. Introduction

Traditional tools and instruments of assessment the robustness/creditworthiness of a company were suddenly beginning to raise doubts; this situation called for the need of additional information provided by the very economic and financial analysis. There can be remembered four factors that favored the extension of economic analysis:

- ❑ there is an increase in various types of risks in global competition between companies as business becomes chaotic, hardly predictable [2];
- ❑ capital markets have experienced a spectacular development both in size recorded every year, and in types of securities traded; potential investors increase their demands in the sense of being better informed, before resorting to notable acquisitions of shares;
- ❑ new securities that are traded in the secondary or major capital market and sufficiently sophisticated new financial instruments - to which the small investor is a victim almost certain - start to appear;
- ❑ main rating agencies that exist at a global level (Standard & Poor's, Moody's, Fitch IBCA) [6-8] were charged explicitly public about certain conflicts of interest to corporations assessed; rating agencies were not able to foresee the current global crisis and they misled a large number of investors, individuals and businesses.

With the advent of computers, automated data processing enables on one hand the possibility to obtain system state information, typically structured and on the other hand, the possibility for the information in taking the decision of system's functioning to undergo corrections. With the diagnosis, regardless of the method of obtaining information, there are found critical points in the system and they are immediately notified to the top management to initiate control measures.

2. Theoretical aspects

Accounting information is provided by means of financial and accounting synthesis documents, reflecting clearly, accurately, fully and regularly the economic, financial and patrimonial situation of the economic entity [5]. These documents are called *financial reports* or financial statements and they may be interim or annual. The European Accounting Directives will meet the same invoked type of documents under the generic name of annual *accounts*. They are elaborated respecting some uniformity rules of preparation, checking, approval and publication [1], according to regulatory accounting framework adopted by the entity.

Financial statements have *the aim* of showing the administrative results performed by the entity's management, including how it has used the resources that have been entrusted [2].

The objective of financial statements is to provide information about the financial position, performance and changes in financial position of an entity, information that help users in making economic decisions [4].

Financial statements are intended to contribute to achieving accounting's objective, which is providing information to ensure a fair picture of the financial position, financial performance and changes in financial position of the entity in order for this information to be used by internal and external users. Preparation of financial statements is a complex aggregation process of data to calculate the economic - financial indicators regarding the patrimonial situation and the outcomes [4].

In financial analysis there is a range of methods and models used among which we can mention [9]:

The ABC method (Pareto chart) – it offers a selective analysis of the elements of a phenomenon or a result according to their contribution to the whole.

The ABC method is used primarily in analyzing stocks, costs, customer turnover and economic entity's clientele.

The rates method - the rate used in the financial analysis can be defined as a ratio between two indicators economically comparable to obtaining a value with a greater informational significance than of the two indicators judged separately.

Analysts use the rate method as an operational tool to evaluate the performances and the failures of economic activities. This method can be used to carry out comparative studies in time and space, regarding the performance of economic entities.

The scoring method is part of discriminate analysis methods and it is used in analysis activity, particularly for determining the bankruptcy risk.

Discriminate analysis methods are based on a number of known elements and through calculating the probability it allows classifying in a certain category of entity.

The general model of a score function is a combination of rates which are given meaning coefficients of significance:

$$Z = \sum_{i=1}^n a_i \cdot R_i \quad [1]$$

where a_i = coefficient of significance of i rate

R_i = rates

In elaborating score functions the economic entities are classified into samples corresponding to the categories of firms considered financially "healthy", respectively economic firms considered to be on the verge of bankruptcy.

The additive type is represented by the final cost of a product obtained as the sum of costs of resources from which it was obtained.

$$C = C_1 + C_2 + \dots + C_n \quad [2]$$

Where C - the cost of the product

C_n - the consume cost of the resursource „n"

The multiplicative model is given by the formula of return depending on the rate of commercial return.

$$RE = A_e \cdot \frac{CA}{A_e} \cdot \frac{RE}{CA} \quad [3]$$

where A_e – operating assets

CA/A_e – CA (the turnover) at 1 lei operating assets

RE/CA – commercial rate of return

The balance sheet model is expressed by the formula of the turnover.

$$CA = S_i + I - S_f \quad [4]$$

where CA – the turnover

S_i – initials stock

I - incomes

S_f - final stock

The ratio model is represented as the average length of rotation of current assets:

$$V = S_{AC} / CA \quad [5]$$

where V – the average length of rotation of current assets

S_{AC} - the average balance of operating assets

The combined model combines features of previous models. A good example is the economic rate of return.

$$R_e = \frac{R_c}{\frac{1}{f} + \frac{1}{n}} \cdot 100 \quad [6]$$

where: R_e — the rate of economic return

R_c – the rate of commercial return

f- the turnover at 1 leu fixed assets(CA/A_i)

“n” – the turnover at 1 leu current assets

The analysis models must be designed to properly express the relationship between factors and phenomenon, ensuring complete consistency between mathematics and economic relationship.

3. Results

If we refer to any of the "n" possible business models to be included in the construction of an expert systems (ES) to estimate the risk of bankruptcy, then there are discussed $M_1, M_2 \dots M_n$ models (as generic models to which the designer can report to), a number of variables that will be defined according to the specifics of each model, expressions that will also be defined differently from one model to another and production rules on which will be based the inference engine. The generalization of the problem is presented graphically in Figure 1.

As it is easily inferred from those shown in Figure 1, it may be noticed intuitively that between two or more functions of two or more economic models there is **a major interdependence connection**, as all the "n" economic models included in the analysis leave and/or are based on the same **knowledge** base. More questions are deduced, each with a certain degree of relevance: How can we provide the top management with comparative results of two or more functions in a half-page graphic? Since each model processes other financial accounting indicators, what correspondences and differences are between the score functions displayed? What restrictions do

the predefined structures of the "n" economic models included in the analysis induce for projecting the ES? What are the advantages and disadvantages of such an approach, namely the costs and benefits to top management?

Since we introduced earlier expressions of "business model" of 1, 2, 3, ..., n and knowledge bases, it is appropriate to mention that in the design of the ES based on economic models of highly relative complexity (each) *occur some aspects strictly specific to this type scientific approach*. Precisely, it is noted that the designer himself is required to design and then use in the projection / operation of an ES some *knowledge*, namely:

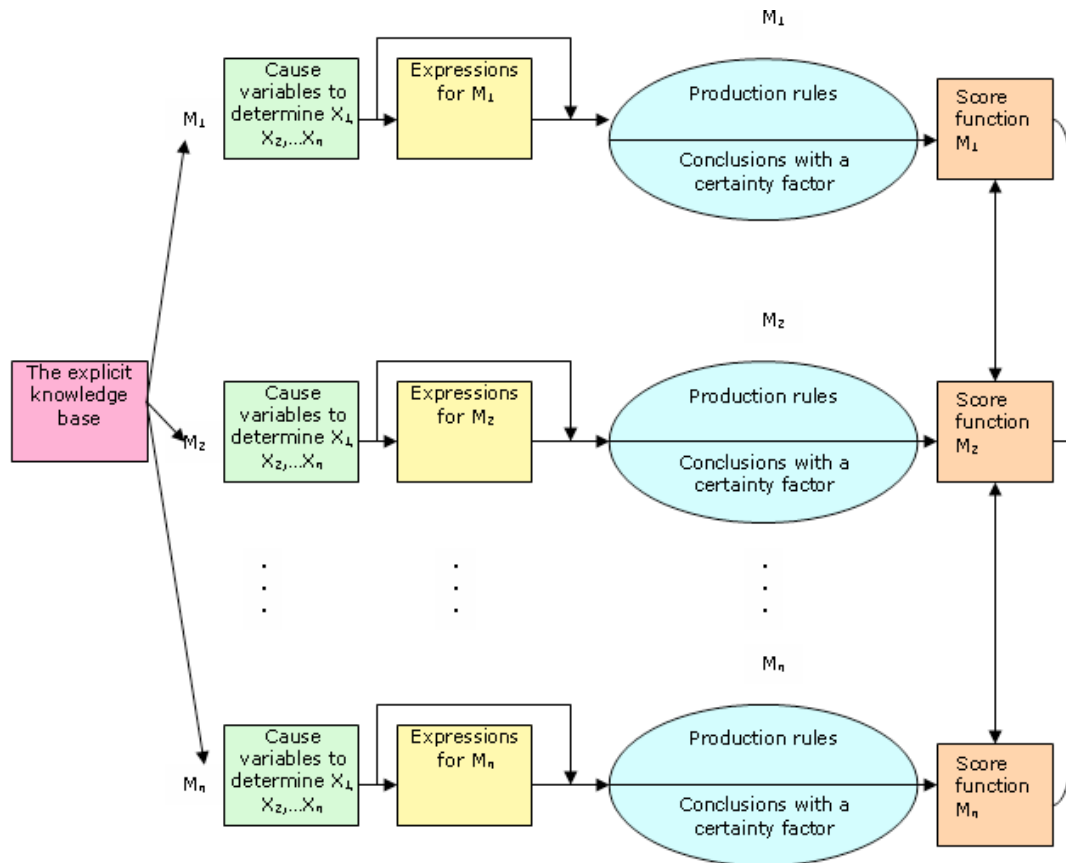


Figure 1 The tree of an ES based on economic models [3]

- when he defines the variables on which the ES will work, he finds that some variables *are accessed only temporarily* in the sequence of items that covered by the inference engine (eg when the current liquidity is defined as a variable in the ES as variable accessed temporarily);
- when defining the expressions from the structure of the ES some of them *are accessed only temporarily* on chain of iterative reasoning of the ES (eg, when the expression of debt ratio is defined);
- when defining production rules which the inference engine is based on some production rules *are accessed only temporarily* as, where appropriate, they block further iteration on a certain structure of logical reasoning graphic or they lead to the moment of assigning a minimum or maximum value, and the used indicator remains on hold during other steps followed by the inference engine.

4. Conclusion

It is noted that the "raw material" on which the entire proposed decision system is based consists of *an ample volume of strictly accounting information* that includes *knowledge*. In fact, including traditional optic of operational and application of models it is based solely on accounting information provided by the balance sheet and other accounting documents (this is the traditional optic regarding the designs of the 80's until present).

The final conclusion is that *it can be designed an ES* for assessing bankruptcy risk of a firm based on the financial statements taking into account various periods of time.

From software's point of view, the application consists of the following:

- editor systems for creating, updating all accounting information in the financial statements;
- expressions and formulas generator;
- inference engine;
- interpreter that takes the program text from the inference engine (according to a rule or formula) and starts running it.

What highlights this expert system is that *it is the first time it is tried "aggregation" or "mixing" several models known in economic theory as a new computer model based on knowledge*.

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