

An evaluation of firms' performance by balance sheet ratios

Una valutazione della *performance* aziendale attraverso
gli indici di bilancio

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Riassunto. Nel presente lavoro di ricerca si vuole perseguire l'obiettivo di determinare un indicatore sintetico di affidabilità aziendale. Attraverso l'analisi esplorativa e l'implementazione di un modello di analisi multivariata si è voluto costruire un indicatore capace di sintetizzare in un unico score sia il livello di affidabilità sia l'efficienza nella gestione delle diverse aree dell'azienda; in particolare, individuati i fattori, sulla base di un modello di analisi fattoriale in componenti principali, è stato elaborato un indicatore di sintesi per la determinazione della probabilità di affidabilità.

Keywords: reliability score, factorial analysis, Rasch model.

1. Introduction

The substantial analysis of balance sheet ratios is one of the most common techniques to study the welfare state of a firm and it represents the tool which the banking system continues referring to in the assurance inquiries.

In literature the research on this matter has brought to the implementation of models which have always concerned – in prevalence – a discrimination between sound firms and anomalous or bankrupt firms, with the purpose of elaborating foretelling models able to establish a potential insolvency state with a certain advance.

Through this research, since we did not know previously the welfare state of the firms, we proposed a synthetic indicator which estimates the probability of reliability of the firm itself. We started from the explorative analysis of the balance sheet ratios and, through the individuation of eight factors, we arrived to the construction of two parameters of firms' performance and to the determination of the same indicator.

2. The inquiring analysis of the indicators

The first step we took was to carry out an inquiring analysis of the data set considered. It proved itself important for the necessity of knowing the phenomenon in consideration in a precise and careful way, in order to achieve a measure of firms' performance probability.

The analysis has concerned the study of 40 balance sheet ratios¹ of 2600 Italian firms belonging to the manufacturing sector regarding the triennium from 2000 to 2002². We determined the position values and variability and we defined a range to estimate the meaning and the weight of along the tails³. After that the explorative analysis allowed to investigate the intensity of the existing link among the covariates and to know the features of the examined firms.

In order to overcome the limits linked to the slight among the economic indexes and to make a better grading of the indexes – through the distance of Mahalanobis – we eliminated those with less discriminating power at a descriptive level⁴.

3. A measure of reliability rating

First of all, factorial analysis has allowed to isolate the most meaningful aspects of the phenomenon, to determinate the dimensions and to reduce the number of the elements to be evaluated. The different factors determined are the fundamental components of evaluation and they represent the new dimensions which the empirical analysis is founded on. From the analysis of the thirty-eight indicators emerged eight factors with eigenvalue greater than the unity which explained the 78% of the variance. We have extracted as many factors as the eigenvalue of correlation matrix of greater than the unity. Then the analysis has been conducted directly on the correlation matrix, therefore, the initial communality of every *item* observed has been estimated equal to the unity. From the result of the *Test of Kaiser-Meyer-Olkin*, equal to 0,78754, we deduced that the factorial model built well fits the data in possession. The factorization has been rather simple because of the great degree of correlation existing among every factor and some of the selected items. We have preferred to rotate the factors according to the varimax method, for a better separation among them, and to make maximum the variance of the squares of the elements in every column of the weights factorial matrix in order to leave unchanged the communality of every variable. The identified factors have underlined the fundamental dimensions which the evaluation about the level of risk of a company is based on. They are: *productive ability and investment capital* (factor 1), *circulating capital* (factor 2), *index of productivity* (factor 3), *sales mark-up* (factor 4), *indebtedness rating* (factor 5), *index of liquidity of the sales* (factor 6), *self-financing index* (factor 7), *immediate liquidity index* (factor 8). From the factors score coefficient matrix, the factorial score has been assigned in order to implement an synthetic indicator; it is able to assign a score of economic and financial reliability to the firm. The implemented indicator is based essentially on the logistic transformation

¹ In detail, indicators of income, of business solidity, of liquidity, of efficiency, of management and of duration (the complete list of the indicators and the methodology we followed for the construction can be asked to the author).

² The database is composed by the companies counted in census in the data bank Eurocredit srl and belonging to the manufacturing sector; in particular, we examined alimentary, textile, clothing, wood and metal industry.

³ Values included below the first decile or above the last decile. The indicators that presented along the tails are: the average stock of the store, the average term of the credits towards the customers, the average length of the debts towards the suppliers, the rotation of the invested capital, the elasticity index, the primary quotient of treasury, the permanent indebtedness index. The identification of along the tails has had the purpose of studying the behavior of the companies with such peculiarities.

⁴ Such excluded indicators are the operative characteristic issue and the current index of liquidity; they are specific indicators already included in other indicators such as the MOL and the total liquidity index.

of the probabilities combined with the values assigned to the individualized factors. In the construction of the indicator, we foresee that the probability of reliability of a firm is function of the difference between two parameters: the first represents the actual level of reliability of a firm and it represents a measure of the indicators performance – called *reliability company parameter* (β_i)⁵ – while the second points out the difficulties of the company in reaching the optimal level – *difficulty company parameter* (δ_j)⁶; the implemented model is formulated as follows:

$$\text{Pr ob}(X_i = k | \beta_i, \delta_i) = \frac{\exp(\beta_i - \delta_i)}{1 + \exp(\beta_i - \delta_i)}$$

The last step has been to implement classes of reliability through the subdivision into classes of the distribution of probability: *not at all reliable*, *little reliable*, *reliable*, *sound*; an area of *uncertainty* which expresses the average level of reliability has been inserted among the classes (tab. 3.1).

Table 3.1 - Distribution of firms by reliability rating.

Reliability rating	Probability	Firms		
		2000	2001	2002
<i>Sound</i>	$0,80 \leq P \leq 1,00$	390 (15,0 %)	313 (12,1 %)	344 (13,3 %)
<i>Reliable</i>	$0,55 \leq P < 0,80$	676 (26,0 %)	719 (27,8 %)	688 (26,7 %)
<i>Uncertainty</i>	$0,45 \leq P < 0,55$	364 (14,0 %)	401 (15,5 %)	348 (13,5 %)
<i>Little reliable</i>	$0,25 \leq P < 0,45$	728 (28,0 %)	698 (27,0 %)	735 (28,5 %)
<i>Not at all reliable</i>	$0,00 \leq P < 0,25$	442 (17,0 %)	456 (17,6 %)	464 (18,0 %)
Totale		2600 (100,0%)	2587 (100,0 %)	2579 (100,0 %)

Source: Our classification based on the empirical research.

In substance, the indicator has been formulated making reference to the same logic that is the basis of the construction of psychometric models, as Rasch's⁷; thus the synthetic indicator has been determined through an objective classification of the data able to establish order relations between the budget indicators and the firms themselves according to a common scale of measure.

4. Some considerations

⁵ It is determined by the ratio between the sum of the synthetical indicators of performance of each factor - weighed both for the factorial weight and the factorial scores - and the same sum of the factorial scores.

⁶ The parameter represents the difficulty that each company meet to obtain a level of optimal performance; it is obtained by the difference between the parameter β^* and the parameter β . The parameter β^* (called optimal reliability company parameter) expresses the optimal level to which, in theory, each company should aim to get the so-called benchmark; it is determined by the best combination of values of each indicator and computing the medium value between the third quartile and the greater outliers – for the increasing indicators - or between the smaller outliers and the first quartile- for the decreasing indicators.

⁷ Elaborated by the Danish Georg Rasch (1960) it was introduced in the field of qualitative analysis and has the fundamental requirements of an objective measurement.

This paper presents the purpose of underlining the existing links among the various ratios and of providing a quantitative measure of the various aspects of the economic-financial management of the analysed firms. The preliminary analysis of the data has been conducted in order to study the main distributive features of the variables.

The factorial analysis into the principal components provided a first synthetic representation of the variability of the observations. Through them a synthetic indicator has been implemented that aims to assign an evaluation of solvency of the firms. Even if the implemented indicator is a first attempt of measurement and empirical analysis, it represents an element of innovation because it determines the probability of reliability through the differences between the reliability company parameter and the difficulty company parameter. The probability of reliability of every company has been determined underlining the spread among the results achieved by each of them with the optimal ones to which it could be.

The profitability index, the immediate liquidity index, the income capacity and the investment capital are the explicative variables that have mainly influenced the construction of the indicator itself. It emerged that the medium performance of the analysed indicators reflected the close slight existing between the reliability rating and the values of the same. In particular, the income indexes and business efficiency reduce going from higher to lower classes of reliability, different from the indicators of property structure that increases.

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