PERGAMON

Omega 29 (2001) 97–109

omega
The International Journal of Management Science

www.elsevier.com/locate/dsw

Assessing financial risks using a multicriteria sorting procedure: the case of country risk assessment

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Received 19 April 1999; accepted 28 April 2000

Abstract

The assessment of financial risks is a problem of major interest for corporate entities (organizations, financial institutions, firms, etc.). The vulnerable economic and financial environments necessitate the development of operational approaches to measure and control financial risks. Most of the methodologies that have been proposed in the past employ a probabilistic notion of risk. This paper proposes an alternative approach to measure financial risks, considering their multidimensional nature. The proposed approach is based on the multicriteria decision aid (MCDA) method Multi-Group Hierarchical DIScrimination (M.H.DIS). The aim of the M.H.DIS method within the financial risk assessment context is to develop a set of additive utility functions that classify the considered alternatives (firms, investment projects, portfolios, countries, etc.) into predefined risk classes. The efficiency of the method is illustrated through a case study regarding the country risk assessment problem. Using the M.H.DIS method a discrimination model is developed that classifies the countries into four groups, and measures the corresponding creditworthiness and risk of the countries. Several validation tests are performed in order to compare the classification results obtained through M.H.DIS to the results obtained through multiple discriminant analysis.

Keywords: Classification; Country risk; Discriminant analysis; Multicriteria

1. Introduction

On a daily basis, the decisions taken by managers of firms are subject to several risks that are mainly caused by the external environment within which firms operate. The most severe risks as far as corporate performance and viability are concerned, are the financial risks that are due to changes in the economic environment (e.g., interest rates, exchange rates, inflation, etc.) and on the operation of corporate entities with which a firm has established some form of cooperation. Changes in such factors that constitute significant sources of financial risks may have a multiplicative effect on the operation of a corporate entity, especially when these factors are related to strategic decisions already taken by the firm. After the recent crises in Southeast Asia and Brazil there has been an evident effect on the operation and performance of firms and organizations with significant strategic investments in these regions.

Although financial researchers have already deter-

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0305-0483/00/$ - see front matter
PII: S0305-0483(00)00028-1

mined that the financial risks constitute the underlying basis of every financial decision problem, the management of such risks still remains a challenging issue. Financial researchers, operations researchers, statisticians, and econometricians have proposed a plethora of methodological approaches to quantify and assess financial risks. Most of the approaches rely on a probabilistic notion of financial risk defined as the variance of the expected return. Towards this direction several optimization techniques have been proposed [3,7]. Such an approach, however, does not always comply with the decision makers' perception of financial risks. Furthermore, the restriction of the financial risk assessment process within a probabilistic context, ignores the effect that the different risk factors may have on the global level of risk. Thus, the necessity for considering the multidimensional nature of financial risks becomes apparent.

Following this methodological framework this paper addresses the financial risk assessment problem through a sorting "problematique" (Roy [10] provides a comprehensive discussion of the different types of decision "problematiques", i.e., choice, ranking, sorting). The sorting "problematique" (also referred to as discrimination or classification) involves the assignment of a set of alternatives into predefined classes. In the case of financial risk assessment, the set of alternatives consists of all the entities (i.e., banks, firms, investment projects, portfolios, countries, etc.), which are evaluated according to the level of financial risks that they entail. For instance, a credit analyst can reduce the financial risk that a debtor (firm or individual) will not be able to repay a loan, by discriminating among creditworthy and financially sound creditors from untrustworthy and risky ones. While several multivariate statistical and econometric analysis techniques (e.g., discriminant analysis, logit and probit analysis, the linear probability model, etc.) have been used to address this type of problems [1], their methodological shortcomings have already led researchers towards the exploitation of new operational approaches [14]. The approach that is presented in this study, namely the M.H.DIS method, originates from the field of multicriteria decision aid (MCDA). The Multi-Group Hierarchical Discrimination (M.H.DIS) method [16] employs a hierarchical discrimination procedure to determine the class in which the alternatives under consideration belong. The method leads to the development of a set of additive utility functions, which are used to decide upon the classification of each alternative into a specific group. The additive utility functions are estimated through the solution of three mathematical programming formulations (two linear and one mixed integer), in order to achieve the "optimal" discrimination both in terms of the number of misclassifications, as well as in terms of the clarity of the discrimination. The method is applied to the country risk assessment problem, in order to develop a model that classifies a sample of 143 countries into four groups according to their economic performance and creditworthiness. The data used are derived from the World Bank and refer to the year 1995 [9,12]. A comparison with discriminant analysis is also performed to evaluate the relative discriminating performance of the M.H.DIS method as opposed to a well-known multivariate statistical technique with numerous applications in financial decision making problems (including country risk assessment [11]). The comparison of the two methods concerns mainly the predictability of the developed discrimination models. Towards this perspective 40 validation tests are conducted in order to have an unbiased estimate of the performance of the two methods.

The rest of the paper is organized as follows. Section 2 presents the basic characteristics, features, mathematical formulation, and operation of the M.H.DIS method. Section 3 is devoted to the application of the method in country risk assessment, and to its compari-

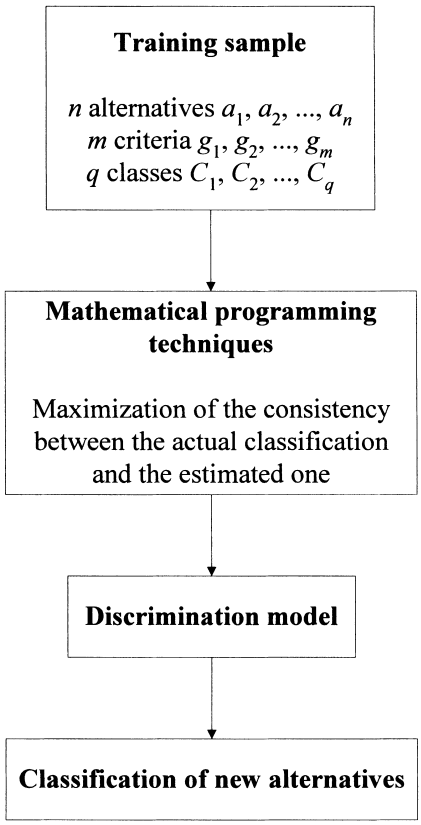

Fig. 1. The regression-based procedure employed in the M.H.DIS method.