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Fuzzy logic approach applied to credit scoring for microfinance in Morocco

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Abstract

Microfinance institutions in Morocco target clients who are excluded from the traditional financial systems and have no guarantees, exposing them to the risks of default and therefore bankruptcy. Also the microfinance sector is experiencing information asymmetry which makes it difficult to apply classical theory given the low databases quality and the lack of depth in the behavioral history of bad customers. The aim of this research is to use fuzzy logic approach that allows an individual and dynamic treatment of the customers by integrating the opinion of the experts in order to evaluate customer behavior to reduce loan default and ensure the viability and the sustainability of the microfinance institutions.
The research used three composed Fuzzy Input variables with their trapezoidal membership function, an output variable and seventy eight fuzzy rules in the development of an evaluation model.

Keywords: Fuzzy logic, credit scoring; microfinance; Morocco; credit risk.

1. Introduction

Several types of risks can affect the survival of a financial institution. Among these risks, we find in particular the market risk, credit risk, operational risk. The credit risk, also known as counterparty risk, is the most common risk.

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The risk management is thus an integral part of the planning of the operational activities of the most large companies and financial institutions because of its importance and its necessity to ensure the sustainability of their activity. Although the risk management is a process that has been prevalent in large institutions for some time, this discipline is still not widespread in the MFIs.

Indeed, the new emphasis on this issue is the result of recent crises and experiences, and reflects a better understanding of the importance to anticipate the unexpected rather than to content with reacting after the fact.

In Morocco, the microfinance sector, in turn, experienced a crisis of over-indebtedness in 2008 [1] as a result of an uncontrolled accelerated growth, which led to the bankruptcy of two MFIs. Indeed, the sector of microfinance is a sector sensitive to the risk given the particularity of its target which is constituted of micro-entrepreneurs excluded from the conventional financial system and not having any guarantee. Especially since there are other factors influencing the loan repayment rate, namely the information asymmetry [2], the type of activities financed and the form of the loan (group loan or individual loan), which induces MFIs to assess subjectively the risk and harms the application of classical theory which requires the availability of a reliable and quality databases in order to insure the representativeness of reality.

To deal with this crisis, the stakeholders of the microfinance sector in Morocco decided to review their process of credit, supervision and information exchange and so introduced new sophisticated methods for managing credit risk including the scoring method [3].

This method corresponds to a set of decision models and underlying techniques that help lenders in the decision to grant loans to reach a single indicator allowing them to distinguish in advance the good from the bad customers.

The aim of this research is to use fuzzy logic approach to evaluate customer behavior in order to reduce loan default and ensure the viability and the sustainability of the microfinance institutions.

Fuzzy logic is useful wherever vagueness of uncertainty exists. It combines both analysis and expert opinions. It has been applied to a wide range of problems which require modeling and control systems including: Industrial control, Human decision making, Image processing, etc.

It is a form of approximate reasoning which is based on 'degrees of truth', as opposed to the usual Boolean or binary (0 or 1) logic, which the modern computer is based on.

This paper includes four parts, which respectively presents the credit scoring, the fuzzy logic approach and its application in the management of credit risk and in the implementation of customer scoring.

2. Credit Scoring

Credit scoring is a "credit rating" technique which began to gain popularity in the 1990s. It is a set of tools that will be used to estimate whether the applicant is solvent and has the ability to repay his loan. This assessment of the borrower is made based on several factors.

Credit Scoring uses quantitative measures of performance and characteristics of previous loans to predict future loan performance with similar characteristics. Credit Scoring does not approve or reject a loan application, but can rather predict the probability of occurrence of poor performance (default) as defined by the lender [4]. The credit scoring technique is illustrated in the figure1 below:

Fig.1. : The Credit Scoring process

Although the use of Credit Scoring for a borrower's risk assessment is not new, it should be noted that the concept is relatively young for microfinance, especially in developing countries.