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Research Paper

Designing an Expert System for Managing Bank Resources and Expenses[1]

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INTRODUCTION

As the most important element of the money market, banks play a vital role in our country's economy. In Iran, the primary factor contributing to the rise in money prices is the unfavorable combination in the structure of banks' sources and expenses. If various economic sectors and the general public can benefit from low-cost banking facilities, the money costs within the banking system should be reduced. This, in turn, depends on effective management and the reduction of bank costs (Naghi Nataj, 2010).

The shorter maturity period of deposits compared to loans and the faster adjustment in relation to current market interest rates exacerbate the issue of mismatch between resources and expenses (deposits and facilities) within the banking system. It is crucial to address this issue in the banking system.

In this article, a data mining-based expert system has been developed to assist planners in managing bank resources and expenses. Expert systems can serve as effective substitutes for experts, mitigating the risk of losing valuable knowledge and experience. The research focused on credit risk assessment within the banking sector, utilizing data mining techniques. By analyzing the input variables that impact the

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balance between bank resources and expenses, the study evaluated and examined these variables. Furthermore, the knowledge obtained from domain experts was incorporated into the system's model, resulting in the design of rules governing the balance of resources and expenses.

In previous research on credit risk, real customers and their characteristics were mostly discussed. However, in this research, legal customers and different characteristics were examined. These characteristics include the company's activity group, the type of legal offices, and the auditor's opinion. In terms of measuring credit risk, this approach differs significantly from similar studies.

One of the most significant innovations of this research compared to previous studies is the inclusion of credit risk measurement using variables specific to legal clients and financial ratios derived from primary data. Additionally, the research examines the measurement of balance sheet items and prioritizes variables through statistical tests and interviews with financial and accounting experts. Moreover, the balance of banking resources and expenses is measured using two variables: credit risk as an external factor and balance sheet items as an internal factor. These aspects contribute to the unique and comprehensive nature of this research compared to others in the field.

RESEARCH METHOD

In terms of purpose, this research is categorized as applied-developmental, and in terms of strategy, it adopts a descriptive survey approach. Financial ratios were measured using the internal analysis method. Initially, data mining was conducted on the dataset of 311 companies recognized as legal clients of Tose'e Saderat Bank, using Rapidminer. The decision tree was created and subsequently validated using the Gini method, chosen for its higher accuracy and precision. Ultimately, the decision tree, comprising 59 rules and influential variables, was integrated into the credit risk subsystem.

On the other hand, the variables and ratios influencing the balance of balance sheet items were carefully selected, prioritized, and graded based on their importance. The ARAS method, combined with library research and consultations with professors and experts, was employed for this purpose. A total of 13 priority variables were identified.

To extract system rules, questionnaires and interviews with experts were conducted. The resulting rules were incorporated into the balance sheet items subsystem, which underwent post-validation. The outputs of both the credit risk subsystem and the balance sheet items subsystem were utilized as inputs for the MATLAB system of banking expense sources. The final output of this system demonstrates a balanced ratio of resources and expenses.

FINDINGS

In the subsystem that assesses the relationship between balance sheet items and their impact on the balance, 175 rules were formulated using 13 variables. These rules were then entered into the MATLAB software based on expert opinions and the results of interviews with them.

The outcomes obtained from these rules indicate either balance or imbalance in the allocation of resources and their utilization (output variable of the expert system). The final results demonstrate that if the credit risk is high but the balance sheet items are optimal, resources and expenses will be in balance. However, if the credit risk is moderate and the balance of the balance sheet items leans towards debt without achieving equilibrium, the resources and expenses of the bank will also lack balance.

In summary, the credit risk and the balance of balance sheet items both play crucial roles in determining whether the resources and expenses of the bank are in balance or not.

Figure 1 illustrates the architecture of the designed news system, serving as the primary finding of the research. On the other hand, Figure 2 displays the final output of the system.

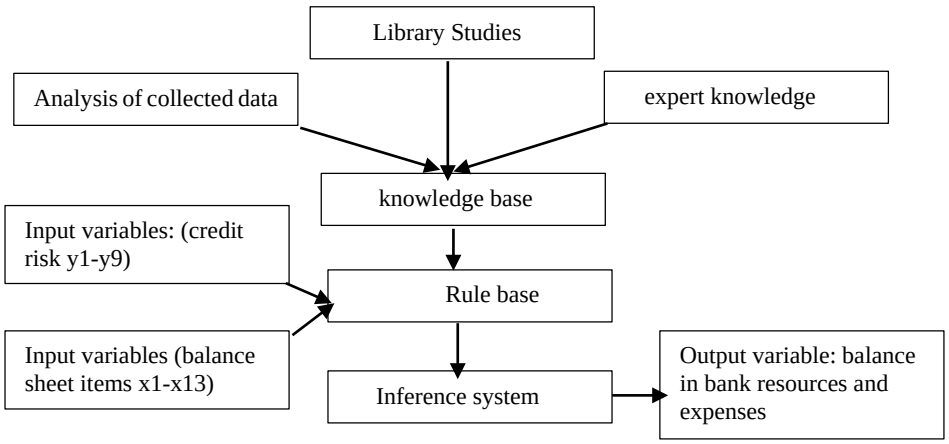

Figure 1. Expert system architecture

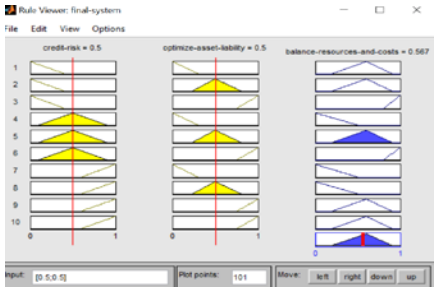

Figure 2. A diagram of the system output

To assess the validity of the fuzzy expert system, five experts were consulted regarding the sub-systems and were asked to provide scores ranging from 0 to 1. The obtained scores were standardized, and subsequently, the Pearson correlation test was conducted to evaluate the correlation between the system results and the expert opinions.

CONCLUSTION

Credit risk assessment in the banking system plays a crucial role in enhancing the efficiency of banks and facilitating the optimal allocation of resources. With this in mind, the effectiveness of a model developed using the Python programming language and the decision tree algorithm in RapidMiner was examined to predict the credit risk of bank customers.

Based on the prediction column in the RapidMiner software, the software estimated the credit risk as 9%, which corresponds to a rating of AA according to the credit risk regulation. This result showcases the model's ability to effectively predict and classify the credit risk level of bank customers.

The financial variables considered in the rules demonstrated results that were not easily predictable or obtainable without the assistance of the model. Among these variables, the ratio of working capital to total assets emerged as a significant indicator in terms of software. Additionally, the history of customer activity with the bank (y3) was identified as a crucial factor in assessing their ability to fulfill obligations.

For customers with a history of activity with the bank of less than three years, it is essential to adopt appropriate and accurate validation methods or employ more conservative financial policies when granting loans. Failing to do so may increase the risk of customers not meeting their obligations, subsequently raising the credit risk for the bank. Therefore, thorough assessment and risk management strategies are crucial for maintaining a healthy credit portfolio.

Considering the efficiency and reliability of the expert system designed in modeling the problem of managing resources and bank expenses, the researchers' suggestion for future research and also to banks is to design an expert system to manage various types of risk, including liquidity risk, market risk, and capital adequacy risk. In the bank, designing a software system in order to measure the balance of balance sheet items and using it, designing a system to neutralize or minimize all kinds of risks in the banking system by maintaining an appropriate level of liquid assets, management control over matching the maturity structure of assets and liabilities, and monitoring the loan-to-deposit ratio can be considered. The design of management dashboard software to measure and manage all types of items that affect the management and balance of banking resources and expenses can also be of interest to researchers and developers of banking information systems.

Keywords: Banking Resources and Expenditures, Credit Risk , Data Mining, Fuzzy ExpertSystem.

JEL Classification: M1 , M4 ,C8.