Available online at www.sciencedirect.com

ScienceDirect

Review of Development Finance 4 (2014) 20–28

Review of DEVELOPMENT FINANCE

www.elsevier.com/locate/rdf

Credit risk assessment model for Jordanian commercial banks: Neural scoring approach

Hussain Ali Bekhet *, Shorouq Fathi Kamel Eletter

Graduate Business School, College of Graduate Studies, Universiti Tenaga Nasional (UNITEN), 43000 Kajang, Selangor, Malaysia

Abstract

Despite the increase in the number of non-performing loans and competition in the banking market, most of the Jordanian commercial banks are reluctant to use data mining tools to support credit decisions. Artificial neural networks represent a new family of statistical techniques and promising data mining tools that have been used successfully in classification problems in many domains. This paper proposes two credit scoring models using data mining techniques to support loan decisions for the Jordanian commercial banks. Loan application evaluation would improve credit decision effectiveness and control loan office tasks, as well as save analysis time and cost. Both accepted and rejected loan applications, from different Jordanian commercial banks, were used to build the credit scoring models. The results indicate that the logistic regression model performed slightly better than the radial basis function model in terms of the overall accuracy rate. However, the radial basis function was superior in identifying those customers who may default.

JEL classification: C45; C52; C83

Keywords: Artificial neural network; Credit scoring; Logistic regression; Credit risk; Commercial bank; Jordan

1. Introduction

Credit loans constitute a cornerstone of the banking industry. The performance of credit department in good standing guarantees profitability and stability of a bank. Therefore, screening the customer's financial history and financial background is a very significant factor before making any credit decision and is a key determinant in reducing credit risk (Bekhet and Eletter, 2012).

Credit risk is the most critical and the biggest challenge facing banks' management. In fact, risk estimate is a major factor contributing to any credit decision, and the inability to precisely determine risk adversely affects credit management. In addition, risk affects both approved and unapproved financing decisions. When credit manager approves a loan, he/she risks the possibility that the customer may be unable to repay his/her obligation. Conversely, when loan is rejected, there is a risk of losing a potentially profitable customer to competitors and the risk of opportunity cost. Hence, credit risk evaluation is essential before making any lending decision.

Lahsasna et al. (2010) emphasized that credit risk decisions are key determinants for the success of financial institutions because of huge losses that result from wrong decisions. Poor evaluation of credit risk can cause money loss (Gouvea, 2007). Wu et al. (2010) stressed that credit risk assessment is the basis of credit risk management in commercial banks and provides the basis for loan decision-making. Furthermore, Angelini et al. (2008) stressed that risk continues to provide a major threat to successful lending despite advancements in credit evaluation techniques and portfolio diversification. Due to the significance of credit risk, a number of studies have proposed embracing data mining tools in banks to improve their risk assessment models and hence increase the prediction accuracy of existing models (Akkoc, 2012; Chen and Huang, 2003; Gao et al., 2006; Huang et al., 2006; Malhorta and Malhorta, 2003; Martens et al., 2007; Tsai and Wu, 2008; West, 2000). Artificial neural networks, genetic algorithms, genetic programming, support vector machines, and some hybrid models have been used to evaluate credit risk with promising results in terms of performance accuracy.

Commercial banks in Jordan are regarded as vitally important and competitive financial organizations that seek profit by

* Corresponding author. Tel.: +603 8928 7326.
E-mail addresses: profhussain@uniten.edu.my, drbekhet1953@hotmail.com (H.A. Bekhet).

Peer review under responsibility of Africagrowth Institute.

Production and hosting by Elsevier

1879-9337 © 2014 Africagrowth Institute. Production and hosting by Elsevier B.V. Open access under CC BY-NC-ND license.
http://dx.doi.org/10.1016/j.rdf.2014.03.002

providing various financial services to households and business firms while managing different types of risk. Consequently, risk taking is often viewed as the basic driver for financial behavior and profitability (Bekhet and Eletter, 2012). In addition, the banking sector contributes significantly to the Jordanian GDP on average by 20% of the country's GDP during 2000–2010 (CBJ, 2002, 2006, 2010; Bekhet and Eletter, 2012; Khrawish, 2011). However, the ratio of non-performing loans to total loans has rapidly increased and reached 7.9% in 2010 compared to 4% in 2007 (Association of Banks in Jordan, 2010). This reflects a slowdown in the country's economic activities as a consequence of the global financial crisis. The rise of the ratio for non-performing loans indicates that some clients are trying to delay paying their financial obligations to banks. Such a situation will increase credit risk and might cause local financial crisis. In fact, bad loans and foreign currency speculations had led to the bankruptcy of Petra Bank (the third largest Jordanian bank) in 1989 and the bankruptcy of Trade and Credit Bank in 1991 (CBJ, 1988, 1989, 1990, 2010, 2011).

As a matter of fact, loan application evaluation at the Jordanian banks is subjective in nature. This entails reviewing each loan application manually, which imposes biases including personal insights, knowledge, and intuition of the credit manager. This method nevertheless has been replaced in a few banks by credit scoring models or a combination of objective and subjective reviews to make proper credit decisions. In fact, subjective decision-making in lending institutions might cause financial crisis or distress. Simultaneously, credit risk assessment is significant in reducing manual errors in credit decisions. On the other hand, banks store data about their customers in data warehouses which can be viewed as hidden knowledge assets that can be accessed and utilized through data mining tools. However, despite the increase in the number of non-performing loans and competition in the banking market, most of the Jordanian commercial banks are unwilling to use data mining tools to support credit decisions. Nevertheless, credit managers at Jordanian banks need to develop more effective models to improve the classification accuracy of credit risk decisions, and recently, artificial neural networks (ANNs) represent a statistical technique and an auspicious data mining tool that have been used successfully in classification problems in many domains.

Therefore, the aim of the current study is to explore the effectiveness of two credit scoring models in the Jordanian commercial banks. Radial basis function (RBF) and logistic regression model in evaluating credit applications were used. The paper also aims to investigate the superiority of the RBF model over logistic regression in screening out potential defaulters. Furthermore, using data mining techniques in application evaluation would improve credit decision effectiveness and control loan officer tasks, as well as save analysis time and cost.

The structure of the paper is as follows: Section 2 discusses the credit scoring models. Section 3 introduces the literature review. Section 4 defines the data sources and definitions of variables. Section 5 describes the methodology and models while Section 6 presents the experimental results and relevant discussion. Finally, Section 7 provides the conclusions and recommendations for further research.

2. Credit scoring

Credit scoring is a group of decision models and their underlying techniques which give support to lenders when providing credit to customers (Heiat, 2012; Thomas et al., 2002). In addition, credit scoring model is a decision support system that helps the managers in financial decision-making process. Chen and Huang (2003) stated that with the rapid development in credit industry, credit scoring models are used on decisions related to credit admission evaluation. These models are developed to classify credit applications as "accepted" or "rejected" with respect to applicants' characteristics such as age, income, and marital status. An application is accepted or rejected based on expectation that the applicant is able or not able to repay his financial obligation. Besides, they emphasized that creditors can build classification rules using previous accepted and rejected applications. Furthermore, they are used to predict borrower's credit risk (Thomas, 2000; Yap et al., 2011). The objective of the credit scoring model is to determine credit applicant's capacity to repay financial obligations by evaluating the credit risk of loan application (Emel et al., 2003; Lee et al., 2002). Credit scoring is a system that aims to classify loan applications; those that have high probability of fulfilling financial obligations are classified as "good" and those that have low probability of fulfilling financial obligations are classified as "bad" (Akkoc, 2012; Gao et al., 2006; Lahsasna et al., 2010; Lee et al., 2002; West, 2000). In addition, Khashman (2010) pointed out that application scoring is one of the two credit scoring tasks which use financial and demographic information of credit applicant in order to classify loan application into "good" or "bad" risk groups.

However, it is necessary to rely on models and algorithms rather than human judgment in consumer lending because of the vast number of decisions involved (Khandani et al., 2010). This highlights the need for accurate decision support model for credit admission evaluation and also for monitoring the ongoing health of credit customers (West et al., 2005). A small improvement in the accuracy of the credit decision might reduce credit risk and translate into important future savings (Chen and Huang, 2003; Hand and Henley, 1997; West, 2000; West et al., 2005; Tsai and Wu, 2008; Lahsasna et al., 2010). In the light of that, credit scoring has been studied widely in accounting and finance literature because of its impacts in lending decisions and profitability of financial institutions (Tsai and Wu, 2008).

Usually, a credit scoring model is built using statistical techniques such as linear discriminant analysis (LDA) and logistic regression (LR). However, artificial neural networks (ANNs) are introduced as promising data mining tools that provide an alternative to statistical techniques in building credit scoring models. Furthermore, artificial neural networks have recently been used successfully in different business applications (Akkoc, 2012; Chen and Huang, 2003; Eletter, 2012; Gao et al., 2006; Huang et al., 2004a; Khashman, 2010; Malhorta and Malhorta, 2003; Martens et al., 2007; Tsai and Wu, 2008; West, 2000).