

# Neural nets versus conventional techniques in credit scoring in Egyptian banking

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## Abstract

Neural nets have become one of the most important tools using in credit scoring. Credit scoring is regarded as a core appraised tool of commercial banks during the last few decades. The purpose of this paper is to investigate the ability of neural nets, such as probabilistic neural nets and multi-layer feed-forward nets, and conventional techniques such as, discriminant analysis, probit analysis and logistic regression, in evaluating credit risk in Egyptian banks applying credit scoring models. The credit scoring task is performed on one bank's personal loans' data-set. The results so far revealed that the neural nets-models gave a better average correct classification rate than the other techniques. A one-way analysis of variance and other tests have been applied, demonstrating that there are some significant differences amongst the means of the correct classification rates, pertaining to different techniques.

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*JEL Classification:* G21; G32

*Keywords:* Neural nets; Conventional techniques; Banking; Credit scoring

## 1. Introduction

The process of credit risk evaluation has the interest of many researchers nowadays. The role of credit risks has changed dramatically over the last 10 decades, from passive automation to a strategic device. Recently, bankers have come to realise that banking operations affect and are affected by the natural environment and that consequently the banks might have an important role to play in helping to raise environmental requirements. Although the environment presents significant risks to banks, in particular, environmental credit risk, it also perhaps presents profitable opportunities (Casu, Girardone, & Molyneux, 2006; Thompson, 1998).

Decision-making of accepting or rejecting a client's credit can be supported by judgemental techniques and/or credit scoring models. The judgemental techniques rely on the knowledge and both past and present experience of

credit analysts, who evaluate the required requisites, such as the personal reputation of a client, the ability to repay credit, guarantees and client's character (Sarlija, Bencic, & Bohacek, 2004). Due to the rapid increase in fund-size invested through credit granted by Egyptian banks, and the need for quantifying credit risk, financial institutions including banks have started to apply credit scoring models.

The structure of the banking system varies from country to country. In the Egyptian environment the structure includes:<sup>1</sup> First, public sector banks (7 banks). Second,

<sup>1</sup> Before the 16th October 2006 the Egyptian banking structure were consists of: commercial banks (28 banks), comprising public sector banks (4 banks) and private and joint venture banks (24 banks); and secondly, business and investment banks (31 banks), comprising private and joint venture banks (11 banks) and branches of foreign banks – off-shore banks – (20 banks). In addition, there are also specialised banks (3 banks), which are the Egyptian Industrial Development Bank, the Arab Egyptian Real Estate Bank and Principal Bank for Development and Agriculture Credit. Egyptian banks abroad are not included, also two banks established under private laws and are not registered with Central Bank of Egypt; namely, Arab International Bank, and Nasser Social Bank (Central Bank of Egypt, 2003/2004).

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private and joint venture banks (28 banks). Third, branches of foreign banks (7 banks). Fourth, branches ceased its operations (9 banks)<sup>2</sup> (see: <http://www.cbe.org.eg/links.htm> for more details).

Since most banks in Egypt are currently using judgemental techniques, it is important to review judgemental techniques versus credit scoring techniques. Sullivan (1981) and Bailey (2004) argue that, in a judgemental technique evaluation, each credit application including information contained with it is evaluated individually by a decision maker “creditor”. The success of a judgemental process depends on the experience and the common sense of the credit analyst. As a result, judgemental techniques are: incongruity, lack of motivation, control and risk quantification.

Otherwise, in a credit scoring model, analysts usually used their historical experience with debtors to derive a quantitative model for the segregation of acceptable and unacceptable credit applications. Using a credit scoring system, a credit application is self-operating processed and consistently all credit decisions are made. The scoring system is based on the addition or subtraction of a statistically extracted number of points relating to the applicant's score given to the predictor variables, such as time on a job or the number of credit sources used. As a result, it can be said that credit scoring enables advancers to assess the credit worthiness quickly. Also, provides moderate scale to adjust the accepted quality by the lenders, and of course provides statistical techniques which enable lenders to measure it. Moreover, credit scoring give a chance to the advancers to improve the customer services process to avoid any estimated future decline. By using a statistically extracted cut-off credit score, an analyst can of course separate the acceptable from the unacceptable credit applicants. On the other hand, credit scoring has been criticized because statistical problems with the data used to evolve the model assumptions of the statistical technique used to derive the point scores. Besides, variables used in a credit scoring system may have the effect of social discrimination. By analysing clients' characteristics to who were once granted credit, the scoring system may provide a bias results because of the different circumstances when those clients or new clients applying for credits. Despite the criticism of credit scoring models, these models can be regarded as one of the most successful models used in the field of business and finance (Bailey, 2004; Sullivan, 1981).

Credit scoring is a quantitative evaluation technique employed by financial institutions “banks” to assess the creditworthiness for both individuals and firms that applies for loans. On other words, the set of decision models that provide lenders in the granting of consumer credit. These techniques assess, and therefore help to decide, who will get credit, how much credit they should get, and what oper-

ational strategies will sustain the profitability of the borrowers to the lenders (Long, 1973; Thomas, Edelman, & Crook, 2002).

Recently neural nets have emerged as a practical technology, with successful applications in many fields in financial institutions in general and banks in particular. Concerning with many problems such as pattern recognition, and make use of feed-forward nets architecture such as the multi-layer feed-forward nets and probabilistic neural nets, are the majority of these applications (Bishop, 1995; Masters, 1995).

Linear regression and discriminant analysis are widely-used statistical techniques, as evidenced in the literature follows. The other methods are: logistic regression, probit analysis, mathematical programming, non-parametric smoothing methods, Markov chain models, expert systems, neural networks, genetic algorithms and others (Hand & Henley, 1997). For such a new banking environment, it would see appropriate, as a first step, to investigate neural nets versus some of the conventional techniques.

Indeed, discriminant analysis and logistic regression are still used in building and developing credit scoring models (Caouette, Altman, & Narayanan, 1998; Desai, Crook, & Overstreet, 1996; Hand & Henley, 1997; Sarlija et al., 2004). Generally, the best technique for all data sets does not exist. Therefore, the main thrust of this paper is to investigate the ability of neural nets such as probabilistic neural nets and multi-layer feed-forward nets, and conventional techniques such as discriminant analysis, probit analysis and logistic regression in evaluating credit risk in Egyptian banks using credit scoring models, in terms of a case study. Discussion with banking officials would suggest that most banks in Egypt are using judgemental techniques in their evaluation process, except a limited number of banks using scoring sheets and/or semi-scoring systems in their evaluation process. We are examining integrated models for the evaluation of consumer credit risks in the banking sector in Egypt; especially since credit scoring models have undergone a noticeable success in different environments in Europe and the US, taking into account all requirements for the proposed models according to the nature of the Egyptian environment.

### 1.1. Neural nets versus traditional statistical methods

Neural nets provide an alternative to conventional statistical techniques. Such as Linear Regression, a function approximation is used. Otherwise, for the classification purposes, discriminant analysis, probit analysis and logistic regression are used. The point of using neural nets is that its capability of modelling extremely complex functions, and of course, this stands in contrast with the traditional linear techniques, such as, linear regression and linear discriminant analysis. Probabilistic neural nets usually trains presented cases faster than multi-layer feed-forward nets, and classifies like or better than multi-layer feed-forward

<sup>2</sup> The board of the CBE agreed to cancel two banks, Jammal Trust Bank and Rafidain Bank, from its record.

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