Chapter 14
Using Genetic Programming Systems as Early Warning to Prevent Bank Failure

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ABSTRACT

Corporate bankruptcy has been always an active area of financial research. Furthermore, after the Lehman Brothers' default and its consequences on the global financial system, this topic has attracted even more attention from regulators and researchers. This event has brought an imperious urge to change the regulatory framework regardless of whether this is good or bad. Consequently, the need for timely signals for supervisory actions and the development of tools that help to determine which financial information is more relevant to predict distress is very important.

During crisis periods the bankruptcy of a bank or a group of banks can make things far worse if contagion effects are transmitted first to other participants of the financial system and then to the real economy. In a previous work, developed by Garcia et al. (2010), an evolutionary technique named Evolving Decision Rules (EDR) was used to identify patterns in data from the Federal Deposit Insurance Corporation (FDIC) for generating a set of comprehensible rules, which were able to predict bank bankruptcy. The major contribution of that work was to show a series of decision rules constituted by simple financial ratios, despite that the method is not restricted to the use of such type of information.

The main advantage of creating understandable rules is that users are able to interpret and identify the events that may trigger bankruptcy. By using the method that we propose in this work, it is possible to identify when certain financial indicators are getting close to specific thresholds, something that can

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turn into an undesirable situation. This is particularly relevant if the companies we are referring to are banks. The contribution of this chapter is to improve the prediction by means of a multi-population approach. The experimental results were evaluated using the Receiver Operating Characteristic (ROC) described in Fawcett and Provost (1997). We show that our approach could improve the Area Under the ROC Curve in 5% with respect to the same method proposed in Garcia et al. (2010). Additionally, a series of experiments were performed in order to find out the reasons of success of the EDR.

INTRODUCTION

Computers have changed several aspects of our lives in an irreversible way and this applies from the design of electronic devices, cars, airplanes to scientific research and social interaction. Today more than ever our society relies heavily on computers and the digital infrastructure which allows the transmission of information and knowledge in a worldwide scale. Economics and Finance are by no means the exception and the way in which humans interact in economic and financial terms has changed because of the computers.

The use of computers in economics is widespread and nowadays it would be very difficult to point out an area of economic research which has not been changed by the use of computers. Examples of the use of computers in economic related areas range from game theory to agent based simulations and econometrics. Additionally, some of the economic problems and their solutions posses algorithmic nature, an aspect which brings them into the arena of computational complexity. Moreover, some of the limitations of the classical economic models have favoured the introduction of alternative computational methods in economic research.

Computational finance[1] is a wide and complex area of research in which computational applications range from Monte Carlo simulations to computer intensive statistical methods and the application of artificial intelligence techniques in financial problems. Strong competition in finance is common as there is always the need to innovate in order to gain competitive advantage or to obtain more profits than other rival firms.

There exists many applications of non-trivial[2] computational techniques in finance. Among such techniques we can find Genetic Algorithms, Genetic Programming (GP) by Koza (1992), Neural Networks, support vector machines, constraint satisfaction among many others. One of the reasons behind the use of non conventional computational techniques in finance is that in machine learning, classification problems are very common and problems like bankruptcy prediction or credit scoring can be modelled as a classification problem. As a consequence, traditional statistical methods might benefit from machine learning approaches to solve similar problems as it has happened the other way around. For example, a local search algorithm known as Guided Local Search (GLS) developed by Voudouris and Tsang (2009), borrowed ideas from the traditional Operations Research field. Nowadays, traditional methods used in finance could benefit from the application of computational techniques either to gain better understanding of the problem or as an alternative way of solving financial problems.

A concrete example of the direct impact of computers in financial markets is the important amount of transactions which are automatically made by computer programs. Such form of transactions are known as automatic or algorithmic trading and there is a view shared by some specialists that such trading might be the responsible for some of the important drops in stock markets. For example in Martinez and Tsang (2009), the authors claim: