

Chapter 5

Predicting Credit Rating Migration Employing Neural Network Models

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ABSTRACT

Credit rating migration ranks amongst the most pertinent issues concerning institutional lenders and investors alike. There are a number of studies that have employed both parametric and non-parametric methodologies to forecast credit rating migration, employing machine learning methods; and notably, artificial intelligence methods becoming increasingly popular. The present study extends upon research within the extant literature employing a novel estimation method, a neural network modelling technique, herewith the MPANN (multi-layer neural network). Consistent with the extant literature, the present article identifies that the legal framework and system of taxation enacted within a polity are pertinent to predicting rating migration. However, extending upon traditional estimation techniques the study identifies that a number of different model calibrations achieve greater predictive accuracy than traditional parametric regression. Notably, the method is able to achieve superior goodness of fit and predictive accuracy in determining credit rating migration than models employed within the extant literature.

INTRODUCTION

Credit rating migration is one of the most significant concerns for institutional lenders and investors alike. Credit rating migration is a risk that individuals or financial institutions are both exposed to. In essence, rating migration is the worsening or upgrading in credit rankings, assigned by an independent ratings agency. There are a number of studies that have employed both parametric and non-parametric methodologies to forecast financial outcomes, employing machine learning methods; and notably,

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artificial intelligence methods becoming increasingly popular, (see inter alia, Martinez et al., 2016). There are only a handful of studies on employing artificial intelligence methodologies to determine their ability to predict changes in credit status. Bhattacharya (2006), found that artificial neural network models had outperformed linear discriminant models; the study gave rise to further studies employing neural network models (see inter alia D’Rosario, 2017). Given the advancements achieved in artificial intelligence methods, such methods can now be employed more efficiently and robustly in application to financial research. The present study seeks to predict credit migration of sovereign ratings in Latin America, employing a multi-layer perceptron, artificial neural network model.

The present study is timely in light of changes to the Basel Accord. The Basel accord has generated interest in credit ratings methodology and prediction since banks and financial institutions employ the prescribed risk weights to determine the probability of default and estimate capital adequacy requirements (Behr and Guttler, 2008). There is an increasing number of users interested to predicting credit migration and the probability of credit rating changes of the borrowers (Jarrow et al., 1997). A few studies have tried employing credit transition matrices (Jarrow et al., 1997). However due to variations in the credit quality of borrowers, various credit rating agencies quote variations in the rating of the same borrower, mainly due to the timing of the changes of credit rating, the current rating grade and various other factors (Hill, Brooks & Faff, 2010). It is noteworthy that the afore stated studies employ traditional parametric methods, rather than the contemporary artificial intelligence methods employed herein.

The critical aspect of credit rating of sovereign bonds is that they act as a signal in the market, which helps government issuers and corporations issuing securities alike to attract both domestic and foreign investment. As noted, there have been a number of studies predicting credit rating migration using credit transition matrices, while others employing financial time series data and associated time series estimation techniques, such as GARCH and related statistical tools in credit rating migration analysis. There is a genuine dearth of studies employing artificial neural network models to predict credit migration of sovereign bonds. Moreover, the majority of credit migration studies focus on individual credit ratings prediction and ratings migration. The present study addresses the dearth of research employing artificial intelligence methods and specifically multi-layer perceptron artificial neural network models to predict the migration of sovereign ratings.

LITERATURE REVIEW

Over the past few years Latin America has seen a change in how foreign capital is acquired. In the 1960’s the alliance program provided assistance, the 1970’s was when the commercial banks had an influx of funding due to the petroleum boom, which led foreign countries to lend aggressively to developing countries. In recent times these nations have become reliant on the IMF and other international agencies and other private sources (Sinclair, 2003). Apart from private funding, sovereign bonds and debt securities issued by government agencies are increasing in popularity in Latin America. Due to the rise in popularity, investors usually look at the credit ratings of major credit rating agencies, such as Moody’s Investor Services, Standard & Poor’s Rating service to assess the likelihood of default. As credit rating agencies have grown in importance and become a key intermediary between investors and borrowers and are nothing less than guardians of capital assigned to emerging markets (Sinclair, 2005).

In recent times due to the increasing complexity of financial markets, it becomes increasingly difficult to assess or predict the credit rating of governments/ sovereign bonds. The more effectively credit migra-

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