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Editorial

Special issue credit risk modelling

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This issue is dedicated to papers on credit risk modelling. Most of the papers were presented at the Credit Scoring and Credit Control XIII conference held in Edinburgh in August 2011 and a few were received in response to an open call for papers on this topic. The papers fall into six broad topic areas: dynamic models, stress testing, loss given default (LGD), data issues, profit scoring and corporate risk modelling.

When including macroeconomic variables within a credit risk model, the analyst is faced with the problem of selecting which macroeconomic variables to choose from a large list that is typically available. In the first paper, Quirini and Vannucci (2014) assume that the macroeconomic credit market conditions move from one state to another following a Markov chain, but are not observable. Associated with each credit market condition there is another Markov chain that contains the transition probabilities of an account moving from one repayment state to another. The authors describe a way to estimate the first Markov chain which is otherwise hidden. In the second paper, Gu *et al* (2014) consider intensity models of default in which the occurrence of default follows a Poisson process with a stochastic intensity parameter. The latter is often assumed to follow a Cox process in continuous time. Gu *et al* (2014) introduce observable trigger events, such as a financial crisis, that lead to defaults occurring. They use the model to derive a new formula to price credit default swaps (CDSs).

The third paper by Bellotti and Crook (2014) presents an account-level discrete hazard model of credit card default that incorporates macroeconomic factors and then simulates their values to gain a distribution of expected losses and associated value at risk. This has the advantage that the relative frequency of observing future values is derived from past frequencies. However, when simulating macroeconomic variable values to conduct a stress test it is important to maintain the appropriate covariances between the variables. There are several possible ways of doing this. In this paper, the authors extract principal components from macroeconomic variables and then include the factors in the hazard model. In the fourth paper, by Seah *et al* (2014), stress tests in the form of macroeconomic scenarios are presented to two types of models of portfolio-level default rates. These models include not only macroeconomic variables, but also dummies to account for differences over time in management actions on the portfolio. The first type is a regression equation of portfolio default rate on macroeconomic variables and management action dummies, with autocorrelated errors. The second is a dual-time dynamics model, where the default rate over time was modelled as were seasonality factors and both included in a model of default rate on macroeconomic variables with managerial decision dummies. The method is illustrated using two credit card portfolios.

The next three papers are on LGD. In Paper 5, Leow *et al* (2014) contrast the effects of macroeconomic variables on two models: one of LGD for a mortgage portfolio and the other a model of LGD for a credit card portfolio. They find that several macroeconomic variables enhance predictive accuracy of LGD for the mortgage portfolio with interest rates being the most important but only during downturns. Macroeconomic variables did not improve the predictive accuracy of the model for credit card LGD. In Paper 6, Martens *et al* (2014) compare the predictive accuracy of different algorithms for modelling LGD. These techniques include ordinary least squares, non-linear Support Vector Regression (SVR), a two stage model combining a linear regression with SVR and a regression tree. They find that the 'two-stage' model for home equity and the transformed linear model for corporate default are best for out-of-time predictions but the non-linear SVR is the least accurate method. The third paper relating to LGD, by Rösch and Scheule (2014), develops a model for jointly estimating recovery rates given default, probabilities of default and asset correlations. They argue that estimated recovery rates parameterised using regression for samples of loans with only non-zero (logarithm of) recovery rates or treating zero values as regular values are biased and inconsistent and they present estimators that are consistent. They present estimates for defaulted corporate bonds.

The issue of selection is also considered in the first of the next group of papers. Hand and Adams (2014) point out that sample selection bias is likely to occur in many contexts in credit risk model building. A common example is where a model is estimated using cases that have been accepted, and so had a low predicted probability of default, by an earlier model. The authors then show that when using such a sample to compare the performance of a new scorecard with a currently used model, several performance metrics that are commonly used such as the area under the receiver operating curve and the Kolmogorov–Smirnov statistic, give results biased in favour of the new model. This has profound implications for credit risk modellers in financial institutions. The authors go on to suggest a practical technique to surmount this problem. The next paper, by Florez-Lopez and Ramon-Jeronimo (2014), considers low default portfolios, that is portfolios with a low number of defaults or a small number of cases. The authors argue that

two problems arise in this context: one associated with the class imbalance and the other being a specification error bias associated with the small sample size. They compare the accuracies of several classifiers individually with those of combined classifiers. A bootstrap technique is used to assess predictive accuracy. They find, using two different data sets, that the combined classifiers produce greater predictive accuracy than any individual classifier when classifying accounts into two or multiple classes.

The next group of two papers concern models for pricing and/or profits. Oliver and Oliver (2014) provide a theoretical model that gives the loan rate that maximises the expected return on equity for a loan portfolio. The model contains one lender and multiple borrowers. The lender makes an offer to each borrower who may accept or reject it. The lender's choice of interest rate is informed by the expected risk of the borrower and the expected response to the offer. The solutions allow for the default rate to depend on the interest rate charged and adverse selection may be present. The second paper, by Sanchez-Barrios *et al* (2014), argues that rather than the cumulative profits that an account is expected to yield profit relative to balance is a more appropriate business objective. Using a large sample of loans they then compare two methods for predicting this profitability measure: a direct method that models profitability with observable covariates and an indirect method. They find the former is more accurate than the latter.

The final group of papers relates to corporate credit risk. Ando (2014) presents new models from which the investors' view of the term structure of default probabilities and the recovery rate can be inferred for a corporate bond. The models are for corporate bond prices and the CDS premium and are estimated using quasi-Bayesian methods. The models have the advantage compared with previous models in that they do not assume a particular distribution for the noise term in the diffusion equation that underlies such models. In the final paper, Li *et al* (2014) examine whether including direct measures of company efficiency as covariates in a model of corporate distress enhances predictive accuracy. The rationale for their inclusion is clear: that in competitive markets the less efficient firms are more likely to suffer losses. The direct measures of efficiency that are used are measures of technical efficiency—pure technical efficiency and scale efficiency—and the degree of returns to scale that can be estimated using Data Envelopment Analysis.

Finally, but certainly not least, we would like to thank the authors for submitting their work to the Special Issue and the referees for evaluating the papers in most cases in several rounds of the review process. We would like also to thank Lyn Thomas for his encouragement throughout this process.

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