



Actuarial Studies Seminar
Macquarie University
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Honours Students Seminar
Department of Actuarial Studies, Macquarie University

Multimodel Inference for Reserving
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Actuaries tend to choose a model for their loss process and project the future conditional on that model, when in fact there may be a number of reasonable models for the process. A problem arises when predictions are conditioned on a single selected model: the predictions are biased, and the parameter uncertainty tends to be underestimated. On the other hand, there is a potentially greater risk involved where the model does not sufficiently describe the data.

This thesis will examine common methods for model selection, including the use of AIC and BIC (Akaike, 1970, and Schwarz, 1978), and related frequentist model selection approaches.

Predictions depend on a given model, and model sensitivity is a topic widely considered by actuaries, and indeed forms part of APRA's GPS310 and the IAAust's PS300. Although model sensitivity is an important issue, measuring the degree to which a predictive distribution is affected by model choice is only one component in properly accounting for model selection uncertainty.

This thesis will describe how sensitivity and model adequacy combine into a single framework for inference involving multiple plausible models which can account for the contribution of model selection uncertainty to the predictive distribution. Under this approach, both the variance and the heaviness of the tail will be impacted. Such an accounting for model selection uncertainty can take place in a Bayesian framework, an information-theoretic framework or even a frequentist framework, with a similar structure in each case. It can be demonstrated that the usual approach to sensitivity analysis can lead to either a substantial over-estimate or under-estimate of actual predictive uncertainty.

The thesis will then describe mechanisms by which model frameworks can be extended so that model specification uncertainty can be incorporated and formally measured. While the

resulting uncertainties are still lower bounds, they are able to include much more of the underlying predictive uncertainty than the usual approach.

Modelling Stochastic Volatility

Janak Ramakrishnan

Abstract Early financial models proved inadequate as they assumed that the movements of the underlying process possessed constant variation. To overcome this flaw models have since been developed in which volatility follows its own stochastic process. The Heston Model (an intuitive extension of the Black-Scholes-Merton model) is a well known framework for jointly modelling volatility and the asset price via a bivariate diffusion process. We discuss the simulation, estimation and calibration of this model to time series. We then develop a semi-parametric extension of the model to overcome some of the weaknesses presented by the assumption of normal movements. Pricing contracts using a stochastic volatility model is in general analytically intractable. Monte-Carlo methods are easily implemented but may be slow and inaccurate. We present a way to overcome this using modern techniques of numerical integration across multiple dimensions.

Reserving Using Bootstrap and Payment Per Claim Incurred

Charles Wang

Abstract Payment per claim incurred is a standard actuarial technique in reserving for general insurer. The method involves the prediction of the total number of claims for each accident year (this prediction is done by methods such as the standard chain ladder method). Then the average payment per claim for each time period can be calculated and prediction can then be made about unknown values. Then the predicted claim amounts is just the predicted average payment per claim multiple by the predicted claim number for the accident year. But the method only produce outcome of a single figure. Which is becoming increasingly unsatisfactory, as actuaries and the regulators wants to know more about the distribution of claims estimate. One way to obtain a distribution is by using bootstrap.

Bootstrap is a statistical technique, for which random values are drawn from the sample to form a pseudo sample. Then estimation of parameters is carried out using the pseudo sample. This is repeated large number of time, and a distribution of the parameter estimate can be obtained.

To obtain a distribution for the predicted values of the reserve, a second bootstrap is used, and the predicted value for each estimation of the parameters is obtained. This then form the distribution of the predicted values.

Investigation of the Actuarial Education Program: Part I and Part II

Zhan Wang

Abstract The aim of the research project is to identify and evaluate the strength and limitation of the actuarial education process, taking the actuarial program offered by Macquarie University as a case study, and in light of theories and approaches to curriculum

development in higher education and feedback and comments made by current actuarial students, hence to identify potentials to make the program a better one.

In the seminar three main aspects of the research will be summarized and presented: evaluation of the current actuarial program offered by Macquarie University, survey result and feedback received from actuarial students (2008), and a promotion of a new unit / project to create a student-centered and interactive learning environment to improve students' 'people skills' and ability to apply existing knowledge to real world type problems.