

## 2009 School Seminar Series

Waikato Management School  
Te Raupapa



# Modelling Extremes in Financial Data: Almost Unbiased Maximum Likelihood Estimation

Tuesday, 5 May 2009  
1.10pm – 2:00pm  
MSB.4.02

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### Abstract

The modeling of extreme values is an important issue in the context of risk analysis. For example, modeling the tails of the distributions of the returns on financial assets is the basis for estimating measures such as value at risk and expected shortfall. In this context, the standard statistical theory leads by necessity to the use of the generalized extreme value distribution, and the generalized Pareto distribution when the “peaks over threshold” procedure is adopted.

The theory of extremes is based on the asymptotic behaviour of order statistics. In practice, however, the estimation of the parameters of the associated distributions is usually based on a relatively small sample of tail observations. The usual desirable asymptotic properties of the maximum likelihood estimators of these parameters may therefore be of little comfort, and it is important to determine the characteristics of the sampling distribution of these estimators in small samples.

Following the general methodology of Cox and Snell (1968), we derive analytic expressions for the biases, to  $O(n^{-1})$ , of the maximum likelihood estimators of the parameters of the generalized Pareto distribution. We then use these expressions to bias-correct the estimators, and this is found to be extremely effective in terms of bias reduction, and generally results in a small reduction in relative mean squared error. In general, the analytic bias-corrected estimators are also found to be superior to the alternative of bias-correction via the bootstrap.

This seminar will provide the background motivation for this research; summarize the Cox-Snell methodology; and discuss the recent results of Giles and Feng (2009) relating to bias reduction in the context of the generalized Pareto distribution

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