Statistics and Finance: The Past, Present and the Future

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The history of the interplay between Finance and Stochastics starts around 1900 with the fundamental work by Bachelier on modelling stock market data using Brownian motion. In the early fifties, statisticians like Maurice Kendall made first detailed analyses on the statistical behaviour of stock-return series. Already soon (Mandelbrot, Fama) one observed that the normality assumptions underlying the modelling of stock price dynamics were insufficient in order to describe quantitative properties of financial markets. This knowledge set the scene for the stormy developments in the early seventies: the Black-Scholes-Merton pricing formula, the emergence of derivatives markets worldwide. Most of the quantitative pricing and hedging models in continuous time still stayed close to assumptions of normality. The birth of quantitative Risk Management (RM, late eighties, early nineties) and the appearance of the first spectacular derivatives' losses (Barings, Orange County, Metalgesellschaft, ...) made regulators and risk managers aware that the statistical properties of financial data needed a more careful scrutiny. Current statistical work in the realm of RM very much concentrates on the analysis and construction of risk measures (VaR, shortfall, ...) for use in the analysis of market, credit and operational risk. In this talk, I will sketch the above development by concrete examples and statistical models used. In a discussion of some of the future issues I will concentrate on the use of Extreme Value Theory and alternative models for dependencies (beyond linear correlation).

Progress with developing statistical models to determine the source and species of recovered illegal rhino horn in Africa based on analyses of its chemistry

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It is often said that "you are what you eat". As elements and different isotopes present in food plants (affected by climate, geology and type of

plant) can be absorbed into rhino horn through the digestive processes, chemical analysis of rhino horn offers the potential of determining both the source of rhino horn as well as the species of rhino that produced it. This paper discusses the statistical analysis of rhino horn chemistry data for samples of horn from populations holding ~70\% of Africa's rhino. After dealing with problems of high data dimensionality, multicolinearity and zero values; successful species and source identification models were built using discriminant functions (often with a 100\% post-hoc classification success). Horn chemistry was also related to rainfall and primary productivity and horn tips did not consistently differ chemically from the rest of the horn. The best source determination models used data from all three labs, and analysed data for the two species separately at the finer spatial scale of park or area within park. Graphical presentation of the results (canonical plots, traces and icon plots) enabled them to be understood by laymen. However, despite these successes, results should be treated as preliminary until independently validated using jackknifing. For other reasons, horn-fingerprinting is not yet at the applied stage, and further data analyses are required.

Experiences in forensic statistics in industry

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In legal matters, statistical evidence often has a key role to play. Uncertainty is a central issue in many legal disputes (otherwise there would not be a dispute!) and the statistician's skills in experimental design, in eliciting evidence from data and in the presentation of this evidence, make him/her an important player in this field. The talk will discuss the role of the statistician in the legal field, contrasting the statistician's and lawyer's interpretations of probability, as well as the importance of Bayesian analysis and the difficulties of applying it in practice. These issues will be illustrated using a number of real cases from the author's experience.

A note on stochastically acceptable quality

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A random variable of quality, characterized by the quality distribution function, is considered both for continuous and discrete cases.

ABSTRACTS OF PAPERS TO BE PRESENTED AT THE 2000 ANNUAL CONFERENCE OF THE SOUTH AFRICAN STATISTICAL ASSOCIATION TO BE HELD AT THE UNIVERSITY OF THE WITWATERSRAND

Building of the Census96 Community Profile summary databases

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The new Statistics Act (No. 6 of 1999) prohibits the disclosure of any information that relates to an individual or a household. As against the practice in the past, unit records for Census96, could therefore not be released. To compensate for the non-availability of unit records Stats SA has compiled 14 Community Profile summary databases for dissemination purposes. These databases, covering different topics, comprise of aggregated information on different variables down to enumerator area level.
The paper will discuss the problems encountered in building the 14 Census96 Community Profile summary databases and how SAS was used to solve the problem.

A Monte Carlo study of three unit root tests

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Monte Carlo experiments are conducted to investigate the finite-sample properties of three commonly used unit root tests for univariate time series processes, with special attention being paid to empirical sizes and empirical powers. The three unit root tests we consider are the Augmented Dickey-Fuller (ADF), the Phillips-Perron (PP), and the Reversed Dickey-Fuller (RDF) tests. Monte Carlo studies show different finite-sample distributions for these three unit root tests. While the PP unit root test procedure proved to be the most powerful among the three, there is no clear preference for either the ADF test or the RDF test as claimed by Leybourne (1995).

Using Census Data to Profile the Poor in South Africa.

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StatsSA