

Editorial

Special Issue on Business, Industry and Government (BIG) Statistics

This special issue of *Applied Stochastic Models in Business and Industry* (ASMBI) reports on the 4th International Symposium on Business and Industrial Statistics (ISBIS4). This was the fourth of a series of international biennial symposia organized by the ISBIS Committee, the preceding events having been held in Linköping, Yokohama and Barcelona.

International Society for Business and Industrial Statistics (ISBIS) is devoted to the advancement and exchange of knowledge in business, financial and industrial statistics. The ISBIS is one of the newest sections of the International Statistical Institute (ISI) and was founded in April 2005. The objectives of the ISBIS are:

- To promote the advancement and exchange of knowledge in business, financial and industrial statistics.
- To build international collaboration among statisticians and users of statistics in business, finance and industry.
- To exchange ideas and information at an international level through conferences, workshops and publications.
- To encourage links between statisticians from developing and developed countries.
- To develop and promote relationships among national and regional professional societies or groups involved in activities related to business, financial and industrial statistics.

The Fourth International Symposium on Business and Industrial Statistics (ISBIS4) was held at Novotel Palm Cove Resort, Tropical North Queensland, during 13–16 April 2005, co-sponsored by ISBIS and by the Statistical Society of Australia (SSAI). It was probably a combination of the attraction of Tropical North Queensland and the excellent promotional work of the Scientific and Organizational Committees that resulted in some 153 delegates from 29 countries, including 47 (about 30%) from Australia. Whilst the majority were academics, there was significant participation from a wide range of business and industrial enterprises. Attendance at scientific sessions was high throughout the conference, despite the competition from tourist attractions in Far North Queensland. The quality of the scientific programme was outstanding, prompting people to attend, at their own expense. The strong focus on areas of important current interest—current and potential applications of Statistics in Finance, and Six Sigma—proved to be very popular.

The conference focussed on important statistical issues relating to productivity improvement, improved use of quantitative methods to support decision-making at all levels of business and industry, and statistical aspects of finance. Needless to say its importance and relevance to the real world resulted in a number of high-profile statistical and business speakers. An important function of the conference was to kick-start the new ISBIS. The Symposium was designed to facilitate interactions between all participants—particularly between academic researchers and

attendees from business, industry and government—through formal presentations, panel discussions and other ‘catalytic’ events, supported by informal social events.

I have received a total of 22 submissions. After a thorough review under the usual journal standards under four guest associate editors and their referees, I accepted 16 papers in this special issue with a wide range of topics. I have put the first eight papers related to industrial statistics and others afterward. A brief description of these accepted papers is given below.

In the leading article of ‘Science, Engineering and Statistics,’ T. P. Davis shows how the principles of symmetry, parsimony together with unification and synthesis, can be applied in engineering to develop an approach to reliability (and engineering in general). It centres on the identification, detection, and avoidance of failure modes through design.

In ‘Damping Factor in Google Page Ranking,’ H. H. Fu, D. K. J. Lin and H. T. Tsai describe how critical is damping factor in changing a website’s ranking in traditional Google PageRank technology. A modified algorithm based on input–output ratio concept is proposed for potential improvement.

In ‘Slope Rotatability over All Directions with Correlated Errors,’ R. N. Das and S. H. Park consider a class of multifactor designs for estimating the slope of second-order response surface when errors in observations are correlated. General conditions for second-order slope rotatability over all directions have been derived assuming errors in observations have a general correlation structure.

In ‘Statistical Modeling for Process Control in the Sawmill Industry,’ R. Beran uses physical understanding to model how systematic and random errors in board thickness accumulate during sequential resawing. The error model is validated on board thickness measurements gathered at northern California sawmill. Through submodelling of the mean vector and the covariance matrix of the measured thicknesses, the paper finds ‘wedging’ in the mean thickness of certain boards and distance-based correlations among the random sawing errors on these boards.

In ‘Statistical Control for Sampling of Metallurgical Material,’ H. Gerber, G. D. Sharp and A. Tessera evaluate three different methods—the refinery’s existing means comparison method, an empirical distribution technique and a non-linear model—to determine which would be the most appropriate one to assess the re-sampling rate of metallurgical material at a precious metal refinery.

During the analysis and inspection of materials, the mass concentration of a compound in a sample is often used as an estimate for the mass concentration in the population. Application of Gy’s theory may result in inaccurate estimate for the minimum sample mass when the selections of the particles are dependent. In ‘Variable Second-Order Inclusion Probabilities During the Sampling of Industrial Mixtures of Particles,’ B. Geelhoed proposes a variable second-order inclusion probability and derives two estimators for the variance. These estimators are compared using samples of aggregates.

In ‘Controlling Dependent Process Steps Using Variable Sampling Size Control Charts,’ S. F. Yang and H. C. Su consider the variable process control scheme for two dependent process steps. The variable sample size (VSS) $Z_{\bar{X}}$ and $Z_{\bar{e}}$ control charts are constructed to effectively monitor the quality variable. The performance of the proposed VSS control charts is measured by the adjusted average time to signal (AATS) using a Markov chain approach.

One of the major cost factors in car manufacturing is the painting of body. In ‘Colour Harmonization in Car Manufacturing Processes,’ A. Andriyashin, M. Benko, W. Hardle, R. Timofeev and U. Ziegenhagen aim to find a reliable technical solution which avoids any

interaction from a human side. They carry out a series of tests in close co-operation with a partner from car industry, combined classical tests and non-parametric smoothing techniques to detect trends in the process of car painting.

Massive data sets are becoming popular in this information era. Due to the limitation of computer memory space and the computing times, the kernel density estimation for massive data sets is rather challenging. In 'Quick Multivariate Kernel Density Estimation for Massive Datasets,' K. F. Cheng, C. K. Chu and D. K. J. Lin propose a quick algorithm for multivariate density estimation method which is suitable for massive data sets. Theoretical properties of their proposed method are developed. Its empirical performance is demonstrated through a credit card example and numerous simulations.

Traditional econometric methods forecast the conditional distribution of asset returns by a point prediction of volatility. In 'Mixture Distribution Based Forecasting Using Stochastic Volatility Models,' A. E. Clements, S. Hurn and S. I. White propose a method by which information extracted from the estimation of a standard stochastic volatility model can be used to generate mixture distribution forecasts. It is shown that forecasts based on mixture distributions are superior to a number of competing approaches.

In 'Bayesian Predictive Inference under Informative Sampling and Transformation,' B. Nanrm, J. W. Choi, G. Shen and C. Burgos consider the problem in which a biased sample is selected from a finite population and inference is required for the finite population means and the super-population mean. The selection probabilities are linear related to the measurements, providing a non-ignorable selection model. The key issue here is the dilemma that a transformation to normality is needed, but this transformation will destroy the linearity between the selection probabilities and the measurements.

Stock market indices from several countries are modelled as discretely sampled diffusions whose parameters change at certain times. In 'Interaction Between Stock Indices *via* Changepoint Analysis,' M. J. Lenardon and A. Anirdjanova estimate these times of parameter changes, using both a sequential likelihood-ratio test and a non-parametric spectral algorithm specifically designed for time series with multiple changepoints. Point-process techniques are used to model the relationships among changepoints of different financial time series.

Structural equation modelling (SEM) is a useful multivariate technique to investigate the causal relationships between variables. In 'Examining the Effects of Customer Service Relationship on Perceived Business Performance *via* Structural Equation Modelling,' Y. B. Wah and K. K. Wei used SEM to model the relationships between critical success factors (CSFs) of business process re-engineering (BPR) implementations, customer service management (CSM) and perceived business performance (PBP) in Malaysian banking institutions.

The classical goodness-of-fit tests for homogeneity and proportional hazards have small power in the case of alternatives when crossings of survival functions are possible. In 'On Goodness-of-fit for Homogeneity and Proportional Hazards,' V. Bagdonavicius and M. Nikulin give test statistics which are oriented against wide classes of alternatives including single or multiple crossings of survival functions.

Drug development in the pharmaceutical industry is increasingly influenced by measures of cost-effectiveness. A problem in this context is that biomarker assessment is typically subject to measurement error which leads to bias in assessing the benefit of a drug, and hence in the assessment of its cost-effectiveness. In 'Measurement Error Bias in Pharmaceutical Cost-Effectiveness Analysis,' I. Marschner discusses the adjustment of cost-effectiveness analyses for measurement error, and considers the potential magnitude of bias that can arise.

Using example calculations in the context of cholesterol lowering therapy, it is demonstrated that such biases can be significant, leading to costs being overestimated by in excess of 25%. Ignoring measurement error in cost-effectiveness analyses can therefore have a substantial effect on the interpretation of such analyses.

Finally, in 'Experimental Designs for 2-Colour cDNA Microarray Experiments,' N. K. Nguyen and E. R. Williams describe an algorithmic approach to construct A-optimal incomplete block designs (IBDs) with up to 100 varieties with equal as well as unequal replications. A catalogue of 2007 IBDs is given.

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