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Editorial

Special Issue on Statistical and Computational Methods in Finance

In recent decades major developments in computational methods allowed revolutionary changes to take place in the statistical and econometric analysis of financial processes. Evaluating various forecasts and policy scenarios with their implied risk using advanced computational techniques and modern financial models is becoming more and more standard practice. The contents of this special issue reflect the growing interest in this area of research.

The journal *Computational Statistics and Data Analysis* has regular issues on computational and financial econometrics, and statistical methods in finance. Of particular interest are papers in important areas of econometric and financial applications where both computational techniques and numerical methods have a major impact (Amendola et al., 2006; Belsley et al., 2007; Geweke et al., 2007; Gilli and Winker, 2007; Pollock and Proietti, 2007). The goal is to provide sources of information about the most recent developments in computational econometrics that are currently scattered throughout publications in specialized areas.

This special issue comprises 18 articles covering a wide range of topics such as dynamic evolution of the volatility of financial returns, model-free measurements of volatility, combination of volatility forecasts, and a transmission mechanism of volatility between markets and operational risk management. Several methodological approaches are proposed based on estimation methods such as MLE, GMM and Bayes and also based on techniques such as copulas, wavelets and geostatistical procedures.

Ruiz and Veiga (this issue) focus on leverage effects and long-memory in volatility. They present a new model: the asymmetric long-memory stochastic volatility (A-LMSV) model to cope with leverage effects. Statistical properties of the new model are derived and compared with the properties of the FIEGARCH model. The results are illustrated by fitting both models so as to represent the dynamic evolution of volatilities of daily returns of the S&P500 and DAX indexes.

The paper by Creal (this issue) compares alternative filtering and smoothing algorithms for estimating stochastic volatility (SV) models when realized volatility is used as an observable measure of the unobserved true volatility. The author examines how well the particle filter compares with the Kalman filter in estimating the integrated variance under a number of different specifications of the model.

Lindström et al. (this issue) introduce a framework based on the state-space formulation of the option valuation model. The performance and computational efficiency of standard and iterated extended Kalman filters are investigated. The tracking time-varying parameters and latent processes such as SV processes have also been studied through a simulation.

Omori and Watanabe (this issue) propose an efficient Bayesian method using Monte Carlo Markov Chain (MCMC) for the estimation of asymmetric SV models. They extend their previous results to develop a block sampler method that can take into account asymmetric effects in the returns.

The paper by Strickland et al. (this issue) examines the effects of parameterization on the simulation efficiency of MCMC algorithms for non-Gaussian state-space models. Specifically, the authors consider the stochastic conditional duration (SCD) and the SV models. They investigate four alternative parameterizations: centred, non-centred in location, non-centred in scale and non-centred in both location and scale. The relations among the simulation efficiency of the MCMC sampler, the magnitudes of the population parameters and the particular parameterizations of the state-space model are examined.

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Heinen and Rengifo (this issue) propose an estimation procedure for the reduced-rank regression (RRR) model in non-Gaussian contexts based on multivariate dispersion models (MDM). A multivariate distribution is created with the help of the Gaussian copula and the estimation is performed using maximum likelihood. Within the framework of MDM, a procedure analogous to canonical correlations is introduced, which takes into account the distribution of the data. Finally, the method is applied to the number of trades of five US department stores on the New York Stock Exchange.

Giet and Lubrano (this issue) are concerned with interest rate models using stochastic differential equations. They propose a more general family of distance metrics, including the Hellinger distance, and investigate the sample dependence when choosing the window size for the non-parametric density estimation. The minimum Hellinger distance estimator (MHDE) is also discussed in a context of a Bayesian framework.

The finite sample properties of the Fourier estimator of integrated volatility in the presence of market microstructure noise are studied by Mancino and Mancino and Sanfelici (this issue). These authors investigate the finite sample properties of the Fourier volatility estimator through both theoretical analysis and simulation experiments. The results are validated by an empirical analysis on high-frequency logarithmic prices of the Italian stock index futures (FIB30).

Chen et al. (this issue) propose regime-switching for modelling size and/or sign asymmetries. A general nonlinear volatility model for the range-based threshold conditional autoregressive model, denoted by TARR, is presented. The proposed model allows forecasts of the intra-day range and captures the most important stylized features of stock return volatility: time clustering and size or sign asymmetry. The focus is on parameter estimation, inference and volatility forecasting in a Bayesian framework.

A new approach for modelling the transmission mechanisms of volatility between markets based on correlated Markov chains is proposed by Gallo and Otranto (this issue). The focus is on a Markov-Switching model called the multi-chain MS model, where asymmetries are inserted by making the transition probability of each market dependent on the state of the other markets. Within this context a number of model restrictions and hypotheses can be tested to stress the role of one market relative to another (spillover, interdependence, comovement, independence, Granger noncausality). The model is estimated on the weekly high–low range of five Asian markets.

Francq and Zakoïan (this issue) propose a procedure for computing the autocovariances and the ARMA representations of the squares, and higher-order powers, of Markov-switching GARCH models. It is shown that many interesting subclasses of the general model can be discriminated in view of their autocovariance structures. A generalized method of moments (GMM) procedure based on the ARMA autocovariances has been derived to estimate the MS-GARCH parameters. It can also be used to determine how many ARMA representations are needed to identify the Markov-switching GARCH parameters. The methodology has been evaluated through a Monte Carlo study and an application to the S&P500 index.

A novel approach to the combination of volatility forecasts in which the optimal combination weights are estimated by the GMM is proposed by Amendola and Storti (this issue). Appropriate conditions are imposed on the standardized residuals implied by a given set of combination weights. The asymptotic properties of the proposed estimator are derived while its finite sample properties are assessed by means of a simulation study. An application to a time series of daily returns on the S&P500 stock market index is considered.

Gallegati (this issue) proposes a multiscaling approach based on a non-decimated discrete wavelet transform in order to investigate the relationship between stock returns and economic activity over different time scales. Particularly, the maximum overlap discrete wavelet transform (MODWT) is applied to the Dow Jones Industrial Average stock price index and the industrial production index for the US. The scaling properties of the series as well as the lead/lag relationship between stock prices and industrial production are investigated.

The long-memory properties of the spot-futures basis and its impact on optimal hedge ratio are explored by Coakley et al. (this issue). A joint fractionally integrated, error-correction and multivariate GARCH (FIEC-BEKK) approach is implemented to capture this feature of the data in addition to time-varying conditional heteroscedasticity. A wild-bootstrap technique confirms the statistical superiority of the variance reduction achieved by the FIEC-BEKK over the OLS methodology for hedging the Gold and $/£ contracts.

Johnson and Sakoulis (this issue) develop a time-varying parameter factor model (TVPFM) using lagged economic factors and industry sectors as portfolio. To capture changing risk premia over time they assume time variation in factor sensitivities approached using dynamic updating in the Kalman filter. The model selection and the parameter estimation have been employed with a Bayesian approach.

Valle and Giudici (this issue) consider the advanced measurement approach (AMA) within the framework of operational risk management. The parameters of the marginal distributions of the losses are estimated with both classical and Bayesian approaches and, in particular, with the MCMC method. The final objective is to obtain the total loss distribution via simulation and to calculate a global risk measure.

The classical problem of modelling dynamic mortality tables is considered by Debón et al. (this issue). The influence of age on data graduation needs to be properly assessed through a dynamic model, as mortality progresses over the years. A new model based on a medianpolish algorithm, which is easily interpretable and allows for observing the evolution along years and ages of the observed phenomenon, is proposed. This setting facilitates the implementation of geostatistical techniques for the estimation of the dependence. The proposed approach has been used to analyse Spanish mortality data.

The computational aspects of employing discrete/continuous (D/C) models in the context of energy demand analysis are considered by Bolduc et al. (this issue). In particular, a wide mixed-logit-based class of discrete-choice model components, which allow for dependent choices, heteroscedasticity and multi-dimensionality, is considered. Tractable and reliable solutions are proposed, which combine the generalized Anderson–Rubin (GAR) procedures and maximum simulated likelihood (MSL) methods for models commonly used in practice. Results are illustrated via Monte Carlo examples and an empirical study on electricity demand.

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