ABSTRACTS

The Power of Bootstrap Tests of Cointegration Rank with Financial Time Series

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The paper estimates the power of bootstrap likelihood ratio tests of cointegration rank using a new computationally inexpensive procedure. In Monte Carlo simulation experiments we show that the power estimates obtained by the procedure are close to the power of the size adjusted test. In most cases the difference in power between the unadjusted asymptotic test and the bootstrap test is substantial. The bootstrap test is found to have low power against stationary alternatives close to a unit root. For such alternatives the power of the test may be close to its size. An empirical application to Euribor interest rates is provided as an illustration of the findings.

Key words: Bootstrap, Cointegration, Financial time series, Likelihood ratio test, Test power

Optimal timing in continuous time under Knightian uncertainty

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We investigate within a continuous time setting how Knightian uncertainty characterized by κ-ignorance affects the optimal timing policies of a risk-neutral and uncertainty averse investor in the case where the exercise payoff is monotonic. We prove that increased ambiguity decreases the value of the optimal timing policy of an uncertainty averse investor. We also show that higher Knightian uncertainty accelerates timing by shrinking the continuation region whenever the termination payoff is independent of the future behavior of the underlying dynamics. If this independence condition is not fulfilled, then our results indicate that higher Knightian uncertainty may decelerate optimal timing.

Exact goodness-of-fit test for proportionality of Hazards

Dario Gasbarra
Department of Mathematics and Statistics, University of Helsinki

We propose an exact statistical test for the proportional hazards model in survival analysis. This is based on the enlargement of filtration idea and it is very much in the spirit of Khmaladze asympotic goodness of fit tests, with the difference that the distribution of our test is computed exactly also for finite samples. This is ajoint work with Sangita Kulathinal and Isha Dewan.

Exit times and invariant distributions for Markov chains

Göran Högnäs
Department of Mathematics, Åbo Akademi

Mark Kac proved in 1947 that the mean return time of a discrete Markov chain to a point x is the reciprocal of the invariant probability $\pi(x)$. This result was generalized to chains on general measurable spaces (under some irreducibility conditions) by Cogburn (1973). I will revisit this classical theme and use the results to study the asymptotics for first exit times for certain autoregressive processes.

De Finetti's control problem and spectrally negative Lévy processes

Andreas E. Kyprianou
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In this talk I will give a review of a recent cluster of literature which has emerged in the last 2-3 years which returns to a classical dividend control problem and reconsiders its solution in a far greater generality using modern concepts from the theory of spectrally negative Lévy processes.

THE OPTIMAL STOPPING PROBLEM OF DUPUIS AND WANG: A GENERALIZATION

JUKKA LEMPA

Abstract. In this paper, we study the optimal stopping problem of Dupuis and Wang analyzed in [1]. In this problem, the underlying follows a linear diffusion but the decision maker is not allowed to stop at any time she desires but rather on the jump times of an independent Poisson process. In [1], the authors solve this problem in the case where the underlying is a geometric Brownian motion and the payoff function is of American call option type. In the current study, we will this problem under relatively weak assumptions on both the underlying and the payoff. We also demonstrate that the results of [1] are recovered from ours.

References

[1] Dupuis, P. and Wang, H. *Optimal Stopping with Random Intervention Times*, 2002, *Advances in Applied Probability*, 34, 141 – 157

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Bayesian Analysis of Participating Life Insurance Contracts with American-Style Options

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We introduce a procedure to determine a point estimate and confidence interval for the fair bonus rate in a participating life insurance contract. We consider a contract which combines a yearly fixed guarantee rate with a bonus rate based on an underlying stock index. The yield of the index is computed from its moving average, and the insurant has the right to reclaim his or her savings at any time before the maturity date. These properties make the contract an American-style path-dependent derivative. We consider the two cases when the riskless interest rate is assumed to be either fixed or deterministic.

We utilize the Bayesian approach to estimate the underlying asset and interest rate models from historical data. The contract prices with given bonus rates are estimated using the regression method. The simulation of the underlying process is based on its posterior predictive distribution, which is, however, adjusted to give risk-neutral dynamics.

The focus is on a novel application of advanced theoretical and computational methods. The flexibility inborn in Markov Chain Monte Carlo methods enables us to deal with a fairly realistic valuation framework, and to address model and parameter error issues. Our empirical results support the use of elaborated instead of stylized models for asset dynamics in practical applications.

GARCH Modelling with Asymmetric Power Exponential Distribution—Applications to Value at Risk Estimation

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We investigate the performance of the GARCH modelling strategy with symmetric and asymmetric power exponential error distributions in predicting VaR values. Some elegance of formulation is gained by expressing the volatility recursion in terms of the power characterizing the power exponential error distribution. At the same time useful asymptotic results become readily

available. Our approach is applied to eight series of daily returns of lengths around 2800. Our overall conclusion is that many types of GARCH models capture the volatility dynamics adequately. Nevertheless, more reasonable estimates for actual VaR values are obtained with bootstrap than with the estimated error distribution.

Pricing and hedging of insurance liabilities in illiquid markets

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We study pricing and hedging of contingent claims in financial markets where trading costs are given by convex cost functions and portfolios are constrained by convex sets. The model does not assume the existence of a cash account. In addition to classical frictionless markets and markets with transaction costs or bid-ask spreads, our framework covers markets with nonlinear illiquidity effects associated with large instantaneous trades.

In the absence of a cash account, it is important to distinguish between cash at different points in time. Accordingly, we study contingent claim processes that may have payouts over their whole life time instead of just the terminal date. The corresponding pricing functionals turn out be similar to convex monetary risk measures with properly modified cash invariance property reflecting the dynamics of the considered framework.

Generalized Rank Test for Testing Cumulative Abnormal Returns in Event Studies

Seppo Pynnönen
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Corrado's (1989) rank test and its modification [Corrado and Zivney (1992)], that accounts for possible volatility changes due to the event effect, appear to have good power properties against the parametric tests of Patell (1976) and Boehmer, Musumeci and Poulsen (BMP) (1991). The Corrado-Zivney test, however, is derived for one-day event window. The ranks of abnormal returns are dependent by construction, which introduces incremental bias in the standard error in the denominator of the simple CAR t-statistic of ranks, used in practice, as the accumulation period grows. This paper proposes a

generalized rank test that can be used both for testing cumulative abnormal returns as well as single abnormal returns. Empirical properties of the test statistics are studied with simulations using CRSP returns. The results show that the some popular test statistics, like the ordinary t-test, as well as the adjusted Corrado-Zivney test with cumulated ranks tend to under-reject the null hypothesis as the CAR period increases. In addition the power of the cumulated ranks Corrado-Zivney test seems suffer when the abnormal return is randomly assigned to a single day within the event window. The suggested generalized rank test is robust against these problems. Furthermore, it is also robust against the event imposed volatility and cross- correlation due to the event day clustering, and has competitive power against the standard parametric tests of Patell and BMP.

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Patell, James, A. (1976). Corporate forecasts of earnings per share and stock price behavior: Empirical test, Journal of Accounting Research 14, 246–276.

On perpetual optimal stopping of Lévy processes

Paavo Salminen
Department of Mathematics, Åbo Akademi

This talk is based on the following paper which is a joint work with Ernesto Mordecki:

Optimal stopping of Hunt and Lévy processes. *Stochastics* 79(3-4), 2007, 233-251

We focus on optimal stopping of Lévy processes and express, in a fairly general special case, the value function of the optimal stopping problem as an expectation of a function of the maximum of the Lévy process. In particular, we analyze our representation for the Novikov-Shiryayev optimal stopping problem.

On an optimization problem in discrete time hedging for European options

Heikki Seppälä
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Assume that $X = (X_t)_{t\in[0,1]}$ is a stochastic process such that $dX_t = \sigma(X_t)dW_t$ and f is the pay off of an European type option. We consider the L_2-approximation error, which occurs when the exact payoff

$$f(X_1) = \mathbb{E}f(X_1) + \int_{(0,1]} \varphi(t, X_t)dX_t \quad a.s.$$

is replaced by a discretely adjusted one arising from adjusting the portfolio only finitely many times. Earlier results by C. and S. Geiss indicate that in most cases the optimal quadratic approximation rate is $\frac{1}{\sqrt{n}}$ when one optimizes over deterministic time-nets of cardinality $n+1$. However, Hujo has shown that there are functions such that the approximation rate is worse than $\frac{1}{\sqrt{n}}$. In this talk we characterize those payoffs f with the approximation rate $\frac{1}{\sqrt{n}}$ by using the functional

$$H_X f(t) := \left\| \sigma \frac{\partial \varphi}{\partial x}(t, X_t) \right\|_{L_2}, \quad t \in [0, 1).$$

We also give conditions for the optimal approximation rate $\frac{1}{\sqrt{n^\beta}}$ with $\beta \in (0, 1)$ in terms of the H_X-functional.

What is Volatility?

Tommi Sottinen Department of Mathematics and Statistics, University of Vaasa

Volatility plays a fundamental rôle in econometric modelling and in option pricing. However, it seems that it is not clear what it is. To illustrate the problem we construct a toy-model that incorporates long-range dependence and heavy tails to the standard Black–Scholes model while keeping the replication prices of options unchanged. So, the volatility as the pricing parameter is the same as in the classical Black–Scholes model, but the historical volatility (standard deviation) is not the same as in the Black–Scholes model. Indeed, the historical volatility may not even exist.

The moral of the story is

- The historical volatility and the implied volatility need not have anything in common.
- The probabilistic properties of the pricing model are mostly irrelevant in option-pricing.

The talk is based on C. Bender, T. Sottinen, and E. Valkeila (2008): Pricing by hedging and no-arbitrage beyond semimartingales. *Finance and Stochastics*, forthcoming.

Modelling Volatility with Conditional Correlation GARCH Models

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Multivariate models of autoregressive conditional heteroskedasticity are used for forecasting volatility in the case where also conditional covariances and not only conditional variances are of interest, that is, when an agent has a whole portfolio of assets. Many types of multivariate GARCH models have been suggested in the literature. In this presentation, the focus is on the class of Conditional Correlation GARCH (CC-GARCH) models. The first representative of this class is the Constant Conditional Correlation GARCH model (Bollerslev, 1990). In this model and its generalisations, the conditional covariance matrix is decomposed into a product of two diagonal matrices of inverted conditional standard deviations and a positive definite matrix of conditional correlations. I shall discuss various generalisations of the Constant CC-GARCH models. I shall emphasise modelling with them and consider a consistent modelling strategy for a subset of them, the class of Smooth Transition CC-GARCH models. I shall also briefly discuss computational properties of software packages of multivariate GARCH models.

A NOTE ON HEDGING OF EUROPEAN OPTIONS IN THE FRACTIONAL BLACK & SCHOLES MARKET MODEL

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Abstract. We discuss some new properties of fractional Black & Scholes market models when the driving fractional Brownian motion has Hurst index $H > \frac{1}{2}$. In this case one can approximate the hedging price of European options in the fractional Black & Scholes market model by a complete and arbitrage free sequence of pricing models ([2]). When the interest rate is equal to zero, the approximate hedging price of an European call is equal to $(S_0 - K)^+$. One gets the same approximate hedging price, if one approximates the fractional B-S market model by the mixed Brownian – fractional Brownian market model (see [1]).

In this talk we show that the following formula is true for an European call

$$(S_T - K)^+ = (S_0 - K)^+ + \int_0^T 1_{\{S_u \geq K\}} dS_u;$$

here $S_u = S_0 e^{B_u^H}$, B^H is a fractional Brownian motion with Hurst index $H > \frac{1}{2}$, and the integral is a (fractional) Lebesgue-Stieltjes integral.

We end the talk with some speculations of the importance of this observation.

The talk is based on joint work with Ehsan Azmoodeh (TKK) and Yuliya Mishura (Kiev).

References

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[2] Valkeila, E. (2007). On the approximation of geometric fractional Brownian motion. Preprint Submitted.