



**FOURTH BRUSSELS-WASEDA SEMINAR  
ON  
TIME SERIES AND FINANCIAL STATISTICS**

ENSAI (Rennes), 18/06/2009  
ECARES -Université libre de Bruxelles, 22/06/2009

**ABSTRACTS**

**ASYMPTOTIC EFFICIENCY OF ESTIMATING FUNCTION ESTIMATORS  
FOR NONLINEAR TIME SERIES MODELS**

Tomoyuki Amano  
Department of Applied Mathematics  
School of Fundamental Science and Engineering, Waseda University

The conditional least squares (CLS) estimators proposed by Tjostheim (1986) are convenient and important for nonlinear time series models. However this convenient estimator is not generally asymptotically efficient. Hence Chandra and Taniguchi (2001) proposed G estimator based on Godambe's asymptotically optimal estimating function. For important nonlinear time series models, e.g., RCA, GARH, nonlinear AR models, we show the asymptotic variance of G estimator is smaller than that of CLS estimator and G estimator is asymptotically efficient if the innovation is Gaussian. Numerical studies for the comparison of the asymptotic variance of G estimator, that of CLS estimator and Fisher information are also given. They elucidate some interesting features of G estimator.

**A REVIEW OF NON-FUNDAMENTALNESS  
AND IDENTIFICATION IN STRUCTURAL VAR MODELS**

Matteo Barigozzi  
ECARES, Université libre de Bruxelles

We review, under a historical perspective, the development of the problem of nonfundamentalness of Moving Average (MA) representations of economic models. Nonfundamentalness typically arises when agents' information space is larger than the econometrician's one. Therefore it is impossible for the latter to use standard econometric techniques, as Vector AutoRegression (VAR), to estimate economic models. We restate the





conditions under which it is possible to invert an MA representation in order to get an ordinary VAR and identify the shocks, which in a VAR are fundamental by construction. By reviewing the work by Lippi and Reichlin [1993] we show that nonfundamental shocks may be very different from fundamental shocks. Therefore, nonfundamental representations should not be ruled out by assumption and indeed methods to detect nonfundamentality have been recently proposed in the literature. Moreover, Structural VAR (SVAR) can be legitimately used for assessing the validity of Dynamic Stochastic General Equilibrium models only if the representation associated with the economic model is fundamental. Factor models can be an alternative to SVAR for validation purposes as they do not have to deal with the problem of nonfundamentality. (Joint with Lucia Alessi, ECB Frankfurt and Marco Capasso, University of Leiden).

SIGNED-RANK OPTIMAL TESTS  
FOR SERIAL CORRELATION AND RANDOM INDIVIDUAL EFFECTS  
IN PANEL DATA

Nezar Bennala  
Université libre de Bruxelles

We are considering three problems of testing for a random effects model with first order serially correlated errors, in a  $n \times T$  panel. The first is the problem of jointly testing for zero first order serial correlation and random individual effects, the second is the problem of testing for no random effects in the presence of local serial correlation, and the third problem is the problem of testing for absence of first order serial correlation in the presence of local random effects. The traditional Lagrange Multiplier tests for these problems have been obtained by Baltagi and Li (1991), for the first, and Bera, Sosa Escudero and Moon (2001), for the two last. We establish local asymptotic normality property (LAN), when  $n$  tends to infinity and  $T$  is fixed. The tests we are proposing are locally asymptotically optimal at correctly specified (symmetric) innovation densities. The pseudo-Gaussian tests (optimal under Gaussian densities but valid under non-Gaussian ones) are investigated. Signed-rank based versions of the optimal parametric procedures, for testing zero serial correlation and random individual effects, are also provided. The efficiency properties of the proposed procedures are investigated by a derivation of their asymptotic relative efficiencies with respect to the corresponding Gaussian parametric tests. Small-sample performances are investigated via a Monte-Carlo study. (Joint with Marc Hallin and Davy Paindaveine).





## TESTING FOR THE DEGREE OF COMMITMENT VIA SET IDENTIFICATION

Laura Coroneo  
ECARES, Université libre de Bruxelles

We propose a new procedure for testing the degree of commitment to time-inconsistent optimal plans, relying on set-identification. The identified set is characterized by means of moment conditions taking the form of inequalities provided by the first order conditions necessary for optimal policy under two alternative regimes: for example, commitment or discretion. We apply this method to the problem of optimal monetary policy and in particular we examine the level of commitment, interpreted as credibility, exhibited by the United States monetary authority. (Joint with Valentina Corradi and Paulo Santos-Monteiro, Warwick University).

## MARKOWITZ PORTFOLIOS REVISITED

Christine De Mol  
ECARES and Department of Mathematics, Université libre de Bruxelles

We consider the classical Markowitz mean-variance portfolio optimization framework, reformulated as a constrained least-squares regression problem, and we propose a new portfolio selection methodology which consists in adding to this quadratic objective function a penalty proportional to the sum of the absolute values of the portfolio weights (L1-type penalty). This penalty regularizes (stabilizes) the optimization problem, encourages sparse portfolios, namely portfolios with only few active positions, and allows to cope with transaction costs. Our approach recovers as special cases the no-short-position portfolios, but does allow for short positions in limited number. We have implemented this methodology on several benchmark portfolio datasets, showing that using only a modest amount of training data, we could construct portfolios whose out-of-sample performance, as measured by Sharpe ratio, was consistently and significantly better than that of the naive portfolio comprising equal investments in each available asset and constituting, as shown in recent literature, a very tough benchmark for portfolio construction. To compute our portfolios we also developed a new algorithm, inspired by LARS (the Least Angle Regression proposed by Efron, Hastie, Johnstone and Tibshirani, *Ann. Statist.* 2004), but which allows to take into account the linear constraints arising naturally in portfolio theory. (This is joint work with Joshua Brodie, Ingrid Daubechies, Domenico Giannone and Ignace Loris).





## ON THE UNIT ROOT PROCESS WITH LOCALLY STATIONARY DISTURBANCES

Junichi Hirukawa  
Department of Mathematics, Niigata University

Random walk is the simplest unstable autoregressive process. It is well-known that the limiting distribution of least squares estimator of AR coefficient in random walk does not satisfy asymptotic normality. The innovation process of random walk can be extended to linear process by means of Beveridge-Nelson decomposition. In this talk we give the further extension of innovation process in which it is assumed to be locally stationary processes. Two different types of non-stationary phenomena simultaneously appear in this model, namely the unit root of AR model and locally stationary disturbance. (Joint with Mako Sadakata).

## ON THE SINGULARITY OF FISHER INFORMATION IN SKEW-SYMMETRIC DENSITY FAMILIES

Christophe Ley  
Université libre de Bruxelles

Testing for symmetry is a fundamental issue when dealing with financial data. A well-known alternative to the null hypothesis of symmetry is the so-called (multivariate) skew-normal model, which embeds the normal distributions into a flexible parametric family of (possibly) skewed distributions. However, in the vicinity of symmetry, skew-normal distributions exhibit a strange yet problematic behavior: the Fisher information matrix associated with the parameters for location and skewness is singular. In this talk, we consider the more general (multivariate) skew-symmetric model, where any symmetric distribution (hence also the normal) is skewed by means of the same mechanism that leads to skew-normal distributions. Within that model, we characterize, for each possible value of the rank of Fisher information matrices, the family of symmetric distributions achieving the corresponding rank. In a second step, the local asymptotic normality property for each such family is established, showing that in those situations some of the components of the parameters cannot be estimated at the usual root- $n$  rate, but only at a slower rate. Finally, optimal (in the Le Cam sense) tests for symmetry in each case are derived. (Joint with Marc Hallin and Davy Paindaveine).





## THE VOLATILITY SHOCKS

Charles Mathias  
ECARES, Université libre de Bruxelles

We compare several volatility measures of a Spanish stock listing from 2001 till 2003. We use the Generalized Dynamic Factor Model and recent results on its factor identification to extract the common shock from these volatility measures. We thereby identify a time series with daily unexpected volatility (joint with Marc Hallin, Hugues Pirotte and David Veredas).

## ESTIMATING FUNCTION APPROACH FOR CHARN MODELS

Hiroaki Ogata  
School of Business Administration, Tokyo Metropolitan University

The method of estimating function is proposed as a bridge between least squares estimator and maximum likelihood estimator. In this talk, we discuss the estimating function approach to CHARN models which include many well-known nonlinear time series models as special cases. We derive the asymptotic normality of the estimating function estimator and the optimal estimating function is also given. In addition, we investigate the empirical likelihood approach. Numerical studies are provided and they show some interesting features of the asymptotics. (Joint with Hiroomi Kanai and Masanobu Taniguchi).

## MULTIVARIATE QUANTILES FROM $L_1$ OPTIMIZATION TO HALFSPACE DEPTH

Davy Paindaveine  
ECARES, Université libre de Bruxelles

A new multivariate concept of quantile, based on a directional version of Koenker and Bassett's traditional regression quantiles, is introduced for multivariate location and multiple-output regression problems. In their empirical version, those quantiles can be computed efficiently via linear programming techniques. Consistency, Bahadur representation and asymptotic normality results are established. Most importantly, the contours generated by those quantiles are shown to coincide with the classical halfspace depth contours associated with the name of Tukey. This relation not only allows for efficient depth contour computations by means of parametric linear programming, but also for transferring from the quantile to the depth universe such asymptotic results as Bahadur representations. We discuss possible applications in a portfolio optimization context. (Joint work with Marc Hallin and Miroslav Šiman).





## TESTING LINEAR CAUSALITY IN MEAN IN PRESENCE OF OTHER FORMS OF CAUSALITY

Hamdi Raïssi  
INSA-IRMAR

This paper consider the test for linear causality in mean in the large set of processes given by Vector Autoregressive (VAR) models with dependent but uncorrelated errors. We see that this framework allows to take into account the possible presence of causality in mean and/or causality in variance. Using the asymptotic normality of the Quasi Maximum Likelihood Estimator (QMLE), we propose various modified tests for testing the causality in mean in presence of dependent errors. We study the finite sample performances of the modified tests by mean of Monte Carlo experiments. An application to the daily returns of the exchange rates of U.S. Dollars (USD hereafter) to one British Pound (BP hereafter) and of USD to one New Zealand Dollar (NZD hereafter) is proposed to illustrate the theoretical results.

## RESAMPLING PROCEDURE TO CONSTRUCT VALUE AT RISK EFFICIENT PORTFOLIOS FOR ARMA-GARCH RETURNS OF ASSETS

Hiroshi Shiraishi  
Jikei Medical University, Tokyo

We discuss resampling procedures to construct Value at Risk (VaR) Efficient Portfolios when returns are vector-valued ARMA-GRCH processes. We investigate a model based bootstrap procedure with minimal model misspecification under ARMA-GARCH model. By use of Bayesian Information Criterion (BIC), we fit the observations to AR(p)-ARCH(q) process. Then, we propose the resampled return process based on the Yule Walker estimator. Finally, we propose estimators of VaR efficient portfolio based on the resampled return process.

## JACKKNIFED WHITTLE ESTIMATORS

Masanobu Taniguchi  
Waseda University, Tokyo

The Whittle estimator has been widely used in time series analysis. Although it is Gaussian asymptotically efficient, it suffers from large bias, especially, when the process concerned has near unit roots. In this paper we introduce the jackknife technique to the Whittle likelihood in the frequency domain, and elucidate the asymptotics of the Jackknifed Whittle estimator. For non-Gaussian stationary processes, it is shown that the second-order bias of it vanishes when the unknown parameter is innovation-free. Some numerical studies confirm





the theoretical results. Because the Whittle estimator is applicable to many fields, e.g., natural sciences, signal processing and econometrics, use of the bias-reduced Jackknifed Whittle estimator is profitable.

#### THE METHOD OF SIMULATED QUANTILES

David Veredas  
ECARES, Université libre de Bruxelles

In this paper we present inference methods based on quantiles, in the sense that functions of theoretical quantiles, which depend on the parameters of the assumed probability law, are matched with empirical quantiles, which depend on data. The optimization is based on simulations and the method provides consistent and asymptotically normal estimators of the parameters of interest. This method is useful for situations where the density function does not have a closed form but it is simple to simulate. A Monte Carlo study based on alpha stable distributions show the usefulness of the approach. (Joint with Yves Dominicy).

#### OPTIMAL RANK-BASED TESTING FOR COMMON PRINCIPAL COMPONENTS

Thomas Verdebout  
Université libre de Bruxelles

The Common Principal Components (CPC) model has been introduced by Flury in 1984. Under such a model,  $m$   $k$ -dimensional populations are assumed to share, with possibly different eigenvalues, the same principal components, that is, the same eigenvectors. Principal component methods, when based on scatter matrices, naturally extend to arbitrary elliptical populations, irrespective of any moment assumptions. We propose rank-based procedures for the null hypothesis of CPC. Those procedures remain valid, thanks to distribution-freeness, under any possibly heterokurtic  $m$ -tuple of elliptical densities (without any moment assumptions). In the homogeneous case, the normal-score version of our signed-rank tests uniformly dominates, in the Pitman sense, the optimal pseudo-Gaussian test. The results are obtained via a nonstandard application of Le Cam's LAN methodology in the context of curved statistical experiments. (Joint with Marc Hallin and Davy Paindaveine).





## QML ESTIMATION AND PREDICTION OF GARCH MODELS

Jean-Michel Zakoïan  
Lille III and CREST

We start by recalling the asymptotic properties of the Gaussian quasi-maximum likelihood estimator (QMLE) in GARCH models. The consistency and asymptotic normality hold under mild conditions, including the strict stationarity of the observed process, the existence of fourth-order moments for the strong white noise driving the dynamics and the non nullity of the volatility coefficients. When the moment condition on the noise is not satisfied, the QMLE remains consistent but may have a non standard asymptotic distribution. When the parameter stands at the boundary of the parameter space, the asymptotic normality is also in failure: the asymptotic distribution is obtained as the projection of a Gaussian vector on the local parameter space. Based on these results, we consider the problem of optimal prediction of powers, or logarithms, of the absolute process. A standard procedure for estimating this prediction is to estimate the volatility by Gaussian QML in a first step, and then use empirical means based on rescaled innovations in a second step. We suggest an alternative one-step procedure, based on an appropriate non-Gaussian QML estimation of the model. The performances of the two approaches are compared.

**We gratefully acknowledge the generous support of** Japan Society for the Promotion of Science, ENSAI, Fonds National de la Recherche Scientifique, Interuniversity Attraction Poles – Belgian Science Policy contract P6/07, and the Université libre de Bruxelles.

