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Editorial

Recent advances in nonstationary time series: A festschrift in honor of Peter C.B. Phillips

1. About the special issue

On July 14–15, 2008, the School of Economics and the Sim Kee Boon Institute for Financial Economics at Singapore Management University (SMU) co-hosted a conference honoring the contribution of Peter Phillips to econometrics and statistics, in celebration of his 60th birthday. In total, 51 papers were presented by his colleagues and former students, who deeply appreciate and respect Peter as a true scholar and a good friend. These papers mainly cover two areas of Peter's current research interests—nonstationary time series analysis, and panel, nonlinear and nonparametric models. On the basis of this conference, we have taken the opportunity to edit two special issues of the *Journal of Econometrics* (JoE), focused on these two research areas, to honor Peter Phillips on his 60th birthday. All papers in the two issues were selected from the SMU conference presentations and subjected to JoE's normal refereeing process. This special issue contains 16 papers dealing with nonstationary time series analysis.

The first paper in this issue, "Useful conclusions from surprising results", was written by Clive Granger.[1] In this stimulating paper, Granger raises provoking research questions as he discusses interesting econometrics examples where theory does not match empirical observations. In studying a specific economic situation, researchers postulate a theoretical model and suggest implications from the theory that should be observed. If practitioners obtain observations (directly or after an econometric analysis) that contradict the theory, a puzzle is found. Granger argues that evaluation and then improvement is part of the natural modeling process. In the presence of puzzles, the researcher needs to ask if she is making unrealistic assumptions and look for ways in which the foundations of the theory can be improved. In some cases, spurious results are found because a strong "shielding factor" exists in the data. When such a "shielding factor" is removed, the researcher may see a surprising hidden property.

The next two papers in this issue consider nonstationary time series with time varying variance. In "Robustifying multivariate trend tests to nonstationary volatility", Xu studies statistical inference on trend coefficients in the presence of unconditional heteroskedasticity. He considers trending time series with a stochastic component represented by a VAR process whose error covariance is a smooth function of t/T, where t and T are, respectively, time and sample size. The limiting distribution of the conventional regression Wald statistic is dependent on nuisance parameters due to the unconditional heteroskedasticity. The limiting behavior of several versions of Wald statistics are studied by Xu, and a bootstrap procedure that facilitates statistical inference is proposed.

Cheng and Phillips study the cointegration problem with smooth unconditional heteroskedasticity in their paper "Cointegrating rank selection in models with time varying variance". They consider the determination of cointegration rank in a reduced rank regression (RRR) with unconditional heteroskedasticity that is modeled nonparametrically. The result extends their previous work to more general settings. The limit theory derived in this paper is useful in studying misspecified reduced rank regressions.

Peter has made seminal contributions on the study of unit root and near unit root models. The next few papers in this issue are related to this topic. "Mean and autocovariance function estimation near the boundary of stationarity" by Giraitis and Phillips analyzes the applicability of standard normal asymptotic theory for stationary time series models with a root close to unity but $n(1-\rho_n) \to \infty$, where ρ_n is the largest AR coefficient and n is the sample size. The region of stationarity and the unit root region are separated by a local to unity region in which the least squares AR estimator has a non-Gaussian limiting distribution. Giraitis and Phillips show that, like the behavior of the AR coefficient estimator, the sample mean and autocovariance functions are also asymptotically normal. The rate of convergence is determined jointly by the sample size and the closeness of the model to the unit root boundary.

Magdalinos also studies autoregression models with a root close to unity in his paper "Mildly explosive autoregression under weak and strong dependence". In particular, he considers mildly explosive autoregressions (in the sense that the AR coefficient $\rho_n = 1 + n^{-\alpha}c$ with $0 < \alpha < 1$ and $c > 0$) with long-range dependent innovations, and investigates the effect of the memory of the innovation process on the limiting behavior of sample moments and the estimator. He shows that although the asymptotic behavior of the sample variance and covariance is affected by the memory of the innovation sequence, their ratio is not affected.

Harvey, Leybourne and Taylor study unit root testing in the paper "Testing for unit roots in the presence of uncertainty over both the trend and the initial condition". They suggest a decision

[1] Clive presented this paper at the conference, and later submitted the paper to this volume. Clive passed away after submitting the first draft of this paper. Undoubtedly, Clive would have added much before the final version of the article was ready, but we decided to retain the draft form, and record his note for posterity. The article has been lightly edited to correct spelling and spacing etc, as well as clarifying the citations (we thank Graham Elliott for his help). Otherwise it remains in Clive's submitted form.

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rule based on the union of rejections of four standard unit root tests (OLS and quasi-differenced de-meaned ADF tests and OLS and quasi-differenced detrended ADF tests) to allow simultaneously for both trend and initial condition uncertainty.

Andrews and Guggenberger study the limiting behavior of several AR estimators in the presence of conditional heteroskedasticity in the paper "Asymptotics for LS, GLS, and feasible GLS statistics in an AR(1) model with conditional heteroskedasticity". Stationary, near stationary, near unit root and unit root processes are all considered. The LS and GLS procedures allow for misspecification of the form of conditional heteroskedasticity. The asymptotic results are established for drifting sequences of parameters.

Xiao's paper, "Robust inference in nonstationary time series models", studies robust inference in unit root and cointegration models. The analysis covers a range of important inference problems including: testing stationarity against unit roots; testing for structure change in nonstationary regressions; and testing for cointegration. These inference problems are analyzed in a unified regression framework, although separate analysis is given for each specific case when it is needed. The proposed inference procedures are constructed on the basis of residuals of robust M-estimations. The limiting behavior of the proposed tests is investigated, and a Monte Carlo experiment is conducted. The proposed tests are easy to use and have advantages in the presence of non-Gaussian data.

Model selection is another field that Peter has made important contributions in. The next few papers in this issue are related to this topic. Choi and Kurozumi study the choices of lag truncation in cointegrating regression with leads and lags in the paper "Model selection criteria for the leads-and-lags cointegrating regression". Leads and lags are usually included in cointegrating regressions to deal with endogeneity. In practice, a truncation of the infinite-order MA process is used in estimation. Choi and Kurozumi study Mallow's C_p, Akaike's AIC, Hurvich and Tsai's corrected AIC, and Schwarz's BIC criteria in the cointegration framework. Unlike in the conventional lag selection problem where the length of lags is assumed to be finite, the true model in leads-and-lags cointegrating regression is an infinite-order moving average one.

In "Model selection when there are multiple breaks", Castle, Doornik and Hendry consider model selection that involves specification uncertainty in the choice of variables and the occurrence of breaks. Their approach, called impulse-indicator saturation, includes an impulse indicator for every observation in the set of candidate regressors. They apply this approach to processes with a heavy-tailed distribution.

Kim's paper, "Model selection in the presence of nonstationarity", considers a Bayesian approach in model selection. Compared with other criteria, the Bayesian approach assigns different weights to the stationary and nonstationary components of a model. Kim shows that the Bayesian approach has the highest parsimony when compared to the AIC, C_p, and $\overline{R}^2$ criteria. The Bayesian model selection criterion also has the best size-adjusted power in large samples. Four different cases of practical interest are discussed in this paper.

The paper "Optimal estimation under nonstandard conditions" by Ploberger and Phillips analyzes optimality properties of the maximum likelihood estimators when the problem does not fall within the locally asymptotically normal class. Their analysis adapts the asymptotic theory of Hájek (1972) and LeCam (1972) to the case where the likelihood may be locally approximated by a quadratic function in large samples. The result in this paper is applicable in nonstandard models such as nonstationary time series.

Shimotsu studies semiparametric estimation of a bivariate fractionally cointegrated system in his paper "Exact local Whittle estimation of fractionally cointegrated systems". The proposed estimator is a two-step procedure. In the first step, a tapered version of the local Whittle estimator of Robinson (2008) is used, and the second-stage estimation uses the exact local Whittle approach of Shimotsu and Phillips (2005). Shimotsu shows that the estimator of the memory parameters has the same Gaussian asymptotic distribution in the stationary and nonstationary cases. The convergence rate and limiting distribution of the estimator of the cointegrating vector are affected by the difference between the memory parameters.

Aït-Sahalia and Park analyze the asymptotic behavior of the specification tests for a diffusion process in "Stationarity-based specification tests for diffusions when the process is nonstationary". Given a diffusion process with parameterized mean and volatility components, estimation of the mean and the volatility functions on the basis of discrete data is challenging. However, any parameterization of the mean and volatility corresponds to a parameterization of the marginal and the transition densities which can be estimated on the basis of discrete data. Aït-Sahalia (1996) proposed model specification tests based on the marginal densities and the transitional densities. While the asymptotic behavior of the Aït-Sahalia (1996) test is derived under the assumption of stationarity, Aït-Sahalia and Park study the asymptotic behavior of their specification tests when the diffusion process is not stationary. Both integrated and explosive processes are considered.

Bauer and Maynard study the Granger causality test in "Persistence-robust surplus-lag Granger causality testing". Previous literature shows that the addition of an untested surplus lag leads to flexible inference in I(0)/I(1) VAR models with unknown integration orders. Bauer and Maynard adopt this surplus-lag approach to an infinite-order VARX setting and propose a Granger causality test that is robust against the degree and nature of the persistence in the causing variables.

In the paper "Spurious regressions in technical trading", Shintani, Yabu and Nagakura investigate the spurious effect in forecasting asset returns when signals from technical trading rules are used as predictors. Their simulation results show that buy or sell signals based on the difference between the short-period and long-period moving averages of past asset prices can be statistically significant when the forecast horizon is long. Their analysis indicates that both "momentum" and "contrarian" strategies can be falsely supported.

2. About Peter C.B. Phillips

Peter C. B. Phillips is one of the most important, prolific and influential econometricians today. He has made seminal contributions to a wide range of key areas in econometrics—from finite-sample theory to asymptotic theory, from frequentist approaches to Bayesian approaches, from discrete-time models to continuous-time models, from parametric models to nonparametric models, from estimation to testing and model selection, from time series analysis to microeconometrics and panel data analysis. One prominent feature of his works is that they are always deeply rooted at the intersection of economic theory, statistics and mathematics, displaying elegance and rigor at the highest level. Peter's research has substantially impacted not only the theoretical development of econometrics today, but also the practical applications of the discipline, especially for empirical researchers who use nonstationary or nearly nonstationary time series data or panel data.

So far, Peter Phillips has published more than 300 articles, 37 of which have appeared in *Econometrica* and 50 in the *Journal of Econometrics*. In addition, he has published or edited four books. According to Research Papers in Economics (RePEc), he has the highest number of journal pages as of November 19, 2011, among economists worldwide. Coupe (2002) ranked him the first in the list of top 1000 economists on the basis of publications over the period 1990–2000. In the Web of Science, he has one paper cited

1501 times, one 923 times, one 603 times and one 405 times as of November 19, 2011.

He has been a Fellow of the Econometric Society since 1981, Fellow of the *Journal of Econometrics* since 1988, Fellow of the American Statistical Association since 1993, Honorary Fellow of the Royal Society of New Zealand since 1994, Fellow of the American Academy of Arts and Sciences since 1996, Fellow of the Modeling and Simulation Society of Australia and New Zealand since 2003, Distinguished Fellow of the New Zealand Association of Economists since 2004, Fellow of the Institute of Mathematical Statistics since 2005, and Corresponding Fellow of the British Academy since 2008.

He has given the Marschak Lecture in 1993 at the Far Eastern Meetings of the Econometric Society, the Fisher–Schultz Lecture in 1994 at the European Meetings of the Econometric Society, the inaugural Hannan Lecture in 1997 at the Australasian Meetings for the Econometric Society, the Sargan Lecture in 2002 at the Royal Economic Society Meetings, and the Fukuzawa Lecture in 2008 at the Far Eastern Meetings of the Econometric Society.

While he works with incredibly high intensity and efficiency to write his own research papers, he is also known to be extremely giving. Many of his colleagues and Ph.D. students have directly benefited from close interactions with him and from his great generosity in sharing ideas. He has been extremely active and energetic with supervising Ph.D. students. To date, he has been the chair or co-chair of more than 60 doctoral dissertations. And many of his Ph.D. students have matured into senior positions in leading research institutions throughout the world. In addition, he also directly influenced many econometricians through research collaborations. Peter's indirect contributions to economics through this generous research collegiality would by itself earn him a distinguished place in the annals of scholarship.

Peter has also made fundamental contributions to the profession through service and initiatives with journals, professional bodies and conference series. He was on the Editorial Board of the *Review of Economic Studies* in 1975–1980, Associate Editor of *Econometrica* in 1978–1984, Advisory Editor of *Macroeconomic Dynamics* in 1996–2004, and Advisory Editor of *New Zealand Economic Papers* from 2007. He established the New Zealand Econometric Study Group conference series in 1997 with John Small and founded the *Asia Pacific Economic Review* with Colin Hargreaves in 1995. In 1984, he founded the journal *Econometric Theory* and has been the editor of the journal since then, establishing the annual sequence of *Econometric Theory Awards* and the Tjalling C. Koopmans Prize for econometricians.

Peter was born on March 23, 1948, in Weymouth, England. He moved to New Zealand at age 9 with the family and attended Mount Albert Grammar School in Auckland. After receiving his Bachelor's degree in Economics, Mathematics and Applied Mathematics and his Master's degree in Economics with first-class honors at the University of Auckland, he won a Commonwealth Scholarship and went to the London School of Economics and Political Science for doctoral studies in 1971, receiving his Ph.D. in 1974. Between 1972 and 1976, he was a Lecturer in Economics at the University of Essex. In 1976, at the age of 28, he was appointed Professor of Econometrics and Social Statistics and Chairman of the Department of Econometrics and Social Statistics at the University of Birmingham. In 1979, he moved across the Atlantic Ocean to take up a full professorship in Economics and Statistics at Yale University. In 1989, he was named Sterling Professor of Economics, the highest academic rank at Yale University. In 1992 he was named Distinguished Alumnus Professor of Economics on home soil at the University of Auckland. Subsequently in 2004, reducing his appointment at Yale to half-time enabled Peter to assume multiple appointments overseas, first as an Adjunct Visiting Professor of Econometrics at the University of York and then from 2009 at the University of Southampton. Since 2005, Peter has been associated with Singapore Management University as a visiting professor between 2005–2007 and as Distinguished Term Professor since 2008. In 2008, he assumed the Co-Directorship of the Center for Financial Econometrics of the Sim Kee Boon Institute for Financial Economics at Singapore Management University, the site of this conference held in Peter's honor.

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