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April 27, 2020

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References with abstracts

[1] Toshihiro Abe and Christophe Ley. "A tractable, parsimonious and flexible model for cylindrical data, with applications". In: *Econometrics and Statistics* 4 (2017), pp. 91 –104. DOI: https://doi.org/10.1016/j.ecosta.2016.04.001.

Keywords: Circular–linear data, Circular–linear regression, Distributions on the cylinder, Sine-skewed von Mises distribution, Weibull distribution.

Abstract: New cylindrical distributions are proposed by combining the sine-skewed von Mises distribution (circular part) with the Weibull distribution (linear part). This new model, the WeiSSVM, enjoys numerous advantages: simple normalizing constant and hence very tractable density, parameter-parsimony and interpretability, good circular–linear dependence structure, easy random number generation thanks to known marginal/conditional distributions, and flexibility illustrated via excellent fitting abilities. Inferential issues, such as independence testing, circular–linear respectively linear–circular regression, can easily be tackled with the new model, which is applied on two real data sets.

[2] Elif F. Acar, Claudia Czado, and Martin Lysy. "Flexible dynamic vine copula models for multivariate time series data". In: *Econometrics and Statistics* 12 (2019), pp. 181 –197. DOI: https://doi.org/10.1016/j.ecosta.2019.03.002.

Keywords: Dynamic vines, Exchange rate dependence, Kendall's tau, Local likelihood, Multivariate time series.

Abstract: The representation of temporal patterns is essential to time series analysis. In the case of two or more time series, one needs to account for temporal patterns not only in each univariate series but also in their joint behavior. A multivariate model is proposed here for the specification of time-varying dependence patterns in multivariate time series in a flexible way. The model is built by first addressing the temporal patterns in each series and then modeling the interdependencies among their innovations using a time-varying vine copula model. To specify the vine decomposition, a heuristic model selection tool that accounts for both the magnitude and variation of the empirical Kendall tau across different time intervals is employed. The time variation in the strength of pairwise dependencies is inferred using nonparametric smoothing techniques, and the uncertainty in

the resulting estimates is assessed using a parametric bootstrap. The methods are evaluated in a simulation study and used to analyze daily exchange rate returns of seven major currencies from August 2005 to August 2016.

[3] M.S. Ahmed, M.K. Attouch, and S. Dabo-Niang. "Binary functional linear models under choice-based sampling". In: *Econometrics and Statistics* 7 (2018), pp. 134 –152. DOI: https://doi.org/10.1016/j.ecosta.2017.07.001.

Keywords: Binary choice model, Functional data analysis, Choice-based sampling, Case-control.

Abstract: A functional binary choice model is explored in a case-control or choice-based sample design context. That is, a model is considered in which the response is binary, the explanatory variable is functional, and the sample is stratified with respect to the values of the response variable. A dimensional reduction of the space of the explanatory random function based on a Karhunen–Loève expansion is used to define a conditional maximum likelihood estimate of the model. Based on this formulation, several asymptotic properties are given. A simulation study and an application to kneading data are used to compare the proposed method with the ordinary maximum likelihood method, which ignores the nature of the sampling. The proposed model yields encouraging results. The potential of the functional choice-based sampling model for integrating special non-random features of the sample, which would have been difficult to see otherwise, is also outlined.

[4] Majid M. Al-Sadoon. "Testing subspace Granger causality". In: *Econometrics and Statistics* 9 (2019), pp. 42 –61. DOI: https://doi.org/10.1016/j.ecosta.2017.08.003.

Keywords: Granger causality, VAR model, Rank testing, Okun's law, Policy trade-offs.

Abstract: The methodology of multivariate Granger non-causality testing at various horizons is extended to allow for inference on its directionality. Empirical manifestations of these subspaces are presented and useful interpretations for them are provided. Simple vector autoregressive models are used to estimate these subspaces and to find their dimensions. The methodology is illustrated by an application to empirical monetary policy, where a conditional form of Okun's law is demonstrated as well as a statistical monetary policy reaction function to oil price changes.

[5] Dawlah Al-Sulami et al. “Estimation for semiparametric nonlinear regression of irregularly located spatial time-series data”. In: *Econometrics and Statistics* 2 (2017), pp. 22 –35. DOI: https://doi.org/10.1016/j.ecosta.2017.01.002.
Keywords: Irregularly spaced sampling locations, Large spatial time series data, Semiparametric spatio-temporal model and estimation, Spatial smoothing.
Abstract: Large spatial time-series data with complex structures collected at irregularly spaced sampling locations are prevalent in a wide range of applications. However, econometric and statistical methodology for nonlinear modeling and analysis of such data remains rare. A semiparametric nonlinear regression is thus proposed for modeling nonlinear relationship between response and covariates, which is location-based and considers both temporal-lag and spatial-neighboring effects, allowing data-generating process nonstationary over space (but turned into stationary series along time) while the sampling spatial grids can be irregular. A semiparametric method for estimation is also developed that is computationally feasible and thus enables application in practice. Asymptotic properties of the proposed estimators are established while numerical simulations are carried for comparisons between estimates before and after spatial smoothing. Empirical application to investigation of housing prices in relation to interest rates in the United States is demonstrated, with a nonlinear threshold structure identified.

[6] Clément Albert et al. “An extreme quantile estimator for the log-generalized Weibull-tail model”. In: *Econometrics and Statistics* 13 (2020), pp. 137 –174. DOI: https://doi.org/10.1016/j.ecosta.2019.01.004.
Keywords: Extreme quantile, Extreme-value theory, Extended regular variation.
Abstract: A new estimator for extreme quantiles is proposed under the log-generalized Weibull-tail model. This model relies on a new regular variation condition which, in some situations, permits to extrapolate further into the tails than the classical assumption in extreme-value theory. The asymptotic normality of the estimator is established and its finite sample properties are illustrated both on simulated and real datasets.

[7] Javier Alejo, Antonio F. Galvao, and Gabriel Montes-Rojas. “Quantile continuous treatment effects”. In: *Econometrics and Statistics* 8

(2018), pp. 13 –36. DOI: https://doi.org/10.1016/j.ecosta.2017.10.004.
Keywords: Continuous treatment, Quantile treatment effects, Quantile regression.
Abstract: Continuous treatments (e.g., doses) arise often in practice. Methods for estimation and inference for quantile treatment effects models with a continuous treatment are proposed. Identification of the parameters of interest, the dose-response functions and the quantile treatment effects, is achieved under the assumption that selection to treatment is based on observable characteristics. An easy to implement semiparametric two-step estimator, where the first step is based on a flexible Box–Cox model is proposed. Uniform consistency and weak convergence of this estimator are established. Practical statistical inference procedures are developed using bootstrap. Monte Carlo simulations show that the proposed methods have good finite sample properties. Finally, the proposed methods are applied to a survey of Massachusetts lottery winners to estimate the unconditional quantile effects of the prize amount, as a proxy of non-labor income changes, on subsequent labor earnings from U.S. Social Security records. The empirical results reveal strong heterogeneity across unconditional quantiles. The study suggests that there is a threshold value in non-labor income that is high enough to make all individuals stop working, and that this applies uniformly for all quantiles. It also shows that the threshold value is monotonic in the quantiles.

[8] Aboubacar Amiri and Sophie Dabo-Niang. "Density estimation over spatio-temporal data streams". In: *Econometrics and Statistics* 5 (2018), pp. 148 –170. DOI: https://doi.org/10.1016/j.ecosta.2017.08.005.
Keywords: Kernel density, Spatio-temporal processes, Weakly dependent data, Recursive kernel.
Abstract: In the last few years, data can be collected extremely easily in many scientific research fields. This became possible by the recent technological advances that have made online monitoring possible. In such situations, if real time or online estimations are expected, the usual nonparametric techniques rapidly require a lot of time to be computed and therefore become useless in practice. Adaptative counterparts of the classical kernel density estimators, that can be updated extremely easily when a new set of observations is available are investigated, for spatio-temporal processes with

weak dependence structures. Mean square, uniform almost sure convergences and a central limit result are obtained under general and easily verifiable conditions. The efficiency of the considered estimators is evaluated through simulations and a real data application. The results show that the proposed method works well within the framework of a spatio-temporal data stream.

[9] Tomohiro Ando, Erricos Kontoghiorghes, and Peter Winker. "CFEnetwork: The annals of computational and financial econometrics, 5th issue". In: *Econometrics and Statistics* 13 (2020), p. 1. DOI: https://doi.org/10.1016/j.ecosta.2019.12.001.

[10] Giovanni Angelini. "Bootstrap lag selection in DSGE models with expectations correction". In: *Econometrics and Statistics* 14 (2020), pp. 38 –48. DOI: https://doi.org/10.1016/j.ecosta.2017.09.002.

Keywords: Dynamic stochastic general equilibrium model, Expectations correction, Dynamic misspecification, Bootstrap, Model selection.

Abstract: A well known feature of DSGE models is that their dynamic structure is generally not consistent with agents' forecasts when the latter are computed from 'unrestricted' models. The expectations correction approach tries to combine the structural form of DSGE models with the best fitting statistical model for the data, taken the lag structure from dynamically more involved state space models. In doing so, the selection of the lag structure of the state space specification is of key importance in this framework. The problem of lag selection in state space models is quite an open issue and bootstrap techniques are shown to be very useful in small samples. To evaluate the empirical performances of our approach, a Monte Carlo simulation study and an empirical illustration based on U.S. quarterly data are provided.

[11] Michelle Anzarut and Ramsés H. Mena. "A Harris process to model stochastic volatility". In: *Econometrics and Statistics* 10 (2019), pp. 151 –169. DOI: https://doi.org/10.1016/j.ecosta.2017.11.001.

Keywords: Harris process, Piecewise constant volatility, Stationary process, Stochastic process estimation, Volatility forecasting.

Abstract: A tractable non-independent increment process is presented. The process arises as an extension of the so-called Harris chains to continuous time being stationary and Feller. Constructions, properties, and inference methods are explored. Moreover, the pro-

cess is used to propose a stochastic volatility model with an arbitrary but fixed invariant distribution which can be tailored to fit different applied scenarios. The model performance is studied through simulation while illustrating its use in practice with empirical work. The model proves to be an interesting competitor to a number of short-range stochastic volatility models.

[12] Josu Arteche and Javier García-Enríquez. "Singular Spectrum Analysis for signal extraction in Stochastic Volatility models". In: *Econometrics and Statistics* 1 (2017), pp. 85 –98. DOI: https://doi.org/10.1016/j.ecosta.2016.09.004.
Keywords: Stochastic Volatility, Singular Spectrum Analysis.
Abstract: Estimating the in-sample volatility is one of the main difficulties that face Stochastic Volatility models when applied to financial time series. A non-parametric strategy based on Singular Spectrum Analysis is proposed to solve this problem. Its main advantage is its generality as it does not impose any parametric restriction on the volatility component and only some spectral structure is needed to identify it separately from noisy components. Its convincing performance is shown in an extensive Monte Carlo analysis that includes stationary and nonstationary long memory, short memory and level shifts in the volatility component, which are models often used for financial time series. Its applicability is finally illustrated in a daily Dow Jones Industrial index series and an intraday series from the Spanish Ibex35 stock index.

[13] Josu Arteche and Jesus Orbe. "A strategy for optimal bandwidth selection in Local Whittle estimation". In: *Econometrics and Statistics* 4 (2017), pp. 3 –17. DOI: https://doi.org/10.1016/j.ecosta.2016.10.003.
Keywords: Long memory, Local Whittle estimation, Bootstrap, Bandwidth selection.
Abstract: The Local Whittle estimator is one of the most popular techniques for estimating the memory parameter in long memory series due to its simple implementation and nice asymptotic properties under mild conditions. However, its empirical performance depends heavily on the bandwidth, that is the band of frequencies used in the estimation. Different choices may lead to different conclusions about, for example, the stationarity of the series or its mean reversion. Optimal bandwidth selection is thus of crucial importance for accurate estimation of the memory parameter, but few strategies for assuring

this have been proposed to date, and their results in applied contexts are poor. A new strategy based on minimising a bootstrap approximation of the mean square error is proposed here and its performance is shown to be convincing in an extensive Monte Carlo analysis and in applications to real series.

[14] Manabu Asai, Michael McAleer, and Shelton Peiris. "Realized stochastic volatility models with generalized Gegenbauer long memory". In: *Econometrics and Statistics* (2019). In press. DOI: https://doi.org/10.1016/j.ecosta.2018.12.005.
Keywords: Stochastic volatility, Realized volatility measure, Long memory, Gegenbauer polynomial, Seasonality, Whittle likelihood.
Abstract: Fractionally differenced processes have received a great deal of attention due to their flexibility in financial applications with long memory. In this paper, new realized stochastic volatility (RSV) models are developed: one is a RSV model with general Gegenbauer long memory (GGLM), while the other is a RSV model with seasonal long memory (SLM). The RSV model uses the information from returns and realized volatility measures simultaneously. The long memory structure of both models can describe unbounded peaks, apart from the origin in the power spectrum. For estimating the RSV–GGLM model, a two step method is suggested: the location parameters for the peaks of the power spectrum are estimated in the first step, while the remaining parameters are estimated based on the Whittle likelihood in the second step. Monte Carlo experiments give results for investigating the finite sample properties of the estimators, with a quasi-likelihood ratio test of the RSV–SLM model against the RSV–GGLM model. The RSV–GGLM and RSV–SLM models are applied to three stock market indices, for which the estimation and forecasting results indicate the adequacy of considering general long memory.

[15] Philipp Bach, Helmut Farbmacher, and Martin Spindler. "Semiparametric count data modeling with an application to health service demand". In: *Econometrics and Statistics* 8 (2018), pp. 125 –140. DOI: https://doi.org/10.1016/j.ecosta.2017.08.004.
Keywords: Semiparametric regression, Nonparametric regression, Count data, Mixed data, Health care demand.
Abstract: Heterogeneous effects are prevalent in many economic settings. As the functional form between outcomes and regressors is generally unknown a priori, a semiparametric negative binomial

count data model is proposed which is based on the local likelihood approach and generalized product kernels. The local likelihood framework allows to leave unspecified the functional form of the conditional mean, while still exploiting basic assumptions of count data models (i.e. non-negativity). Since generalized product kernels allow to simultaneously model discrete and continuous regressors, the curse of dimensionality is substantially reduced. Hence, the applicability of the proposed estimator is increased, for instance in estimation of health service demand where data is frequently mixed. An application of the semiparametric estimator to simulated and real-data from the Oregon Health Insurance Experiment provide results on its performance in terms of prediction and estimation of incremental effects.

[16] Francesco Bartolucci, Silvia Bacci, and Claudia Pigini. "Misspecification test for random effects in generalized linear finite-mixture models for clustered binary and ordered data". In: *Econometrics and Statistics* 3 (2017), pp. 112 –131. DOI: https://doi.org/10.1016/j.ecosta.2016.11.007.

Keywords: Hausman test, Latent class model, Longitudinal data, Multilevel data.

Abstract: An alternative to using normally distributed random effects in a generalized linear mixed model for clustered data is based on assuming discrete random effects. This approach gives rise to a flexible class of finite-mixture models for multilevel and longitudinal data. A general Hausman-type misspecification test is proposed for these models based on the comparison between the marginal and the conditional maximum likelihood estimators of the regression parameters, focusing on the case of binary and ordered response variables. The test is simple to perform and it is particularly useful in detecting the possible correlation between the random effects and individual covariates, a situation often faced by practitioners and that causes severe inconsistency. This type of dependence is accounted for by suitable extensions of classical finite-mixture models. The approach is illustrated by a series of simulations and two empirical examples covering important fields of application.

[17] Luc Bauwens, Manuela Braione, and Giuseppe Storti. "A dynamic component model for forecasting high-dimensional realized covariance matrices". In: *Econometrics and Statistics* 1 (2017), pp. 40 –61. DOI: https://doi.org/10.1016/j.ecosta.2016.09.003.

Keywords: Realized covariance, dynamic component models, multi-step forecasting, iterative algorithm.
Abstract: The Multiplicative MIDAS Realized DCC (MMReDCC) model simultaneously accounts for short and long term dynamics in the conditional (co)volatilities of asset returns, in line with the empirical evidence suggesting that their level is changing over time as a function of economic conditions. Herein the applicability of the model is improved along two directions. First, by proposing an algorithm that relies on the maximization of an iteratively re-computed moment-based profile likelihood function and keeps estimation feasible in large dimensions by mitigating the incidental parameter problem. Second, by illustrating a conditional bootstrap procedure to generate multi-step ahead predictions from the model. In an empirical application on a dataset of forty-six equities, the MMReDCC model is found to statistically outperform the selected benchmarks in terms of in-sample fit as well as in terms of out-of-sample covariance predictions. The latter are mostly significant in periods of high market volatility.

[18] Sebastian Bayer. "Combining Value-at-Risk forecasts using penalized quantile regressions". In: *Econometrics and Statistics* 8 (2018), pp. 56 –77. DOI: https://doi.org/10.1016/j.ecosta.2017.08.001.
Keywords: Value-at-Risk, Forecast combination, Quantile regression, Elastic net, Regularization.
Abstract: Penalized quantile regressions are proposed for the combination of Value-at-Risk forecasts. The primary reason for regularization of the quantile regression estimator with the elastic net, lasso and ridge penalties is multicollinearity among the standalone forecasts, which results in poor forecast performance of the non-regularized estimator due to unstable combination weights. This new approach is applied to combining the Value-at-Risk forecasts of a wide range of frequently used risk models for stocks comprising the Dow Jones Industrial Average Index. Within a thorough comparison analysis, the penalized quantile regressions perform better in terms of backtesting and tick losses than the standalone models and several competing forecast combination approaches. This is particularly evident during the global financial crisis of 2007–2008.

[19] Brendan K. Beare and Xiaoxia Shi. "An improved bootstrap test of density ratio ordering". In: *Econometrics and Statistics* 10 (2019), pp. 9 –26. DOI: https://doi.org/10.1016/j.ecosta.2018.08.002.

Keywords: Contact set, Density ratio ordering, Hadamard directional differentiability, Least concave majorant, Ordinal dominance curve.
Abstract: Two probability distributions with common support are said to exhibit density ratio ordering when they admit a nonincreasing density ratio. Existing statistical tests of the null hypothesis of density ratio ordering are known to be conservative, with null limiting rejection rates below the nominal significance level whenever the two distributions are unequal. It is shown that a bootstrap procedure can be used to raise the pointwise limiting rejection rate to the nominal significance level on the boundary of the null. This improves power against nearby alternatives. The proposed procedure is based on preliminary estimation of a contact set, the form of which is obtained from a novel representation of the Hadamard directional derivative of the least concave majorant operator. Numerical simulations indicate that improvements to power can be very large in moderately sized samples.

[20] Martin Becker and Stefan Klößner. "Fast and reliable computation of generalized synthetic controls". In: *Econometrics and Statistics* 5 (2018), pp. 1 –19. DOI: https://doi.org/10.1016/j.ecosta.2017.08.002.
Keywords: Synthetic control methods, Fast algorithms, Reliable computation.
Abstract: Given that existing implementations of synthetic control methods are plagued by serious weaknesses, new methods are offered for calculating synthetic control units. In particular, it is shown how to detect and handle important special cases that have yet to be addressed. Numerical methods for fast and reliably solving the nested optimization associated with the standard case are also discussed. An open source implementation of the presented methods is provided with the R package MSCMT, which can also be applied to generalizations of 'standard' synthetic control methods.

[21] Wicher P Bergsma. "Regression with I-priors". In: *Econometrics and Statistics* 14 (2020), pp. 89 –111. DOI: https://doi.org/10.1016/j.ecosta.2019.10.002.
Keywords: Classification, Empirical bayes, Fisher information, Functional data analysis, -prior, Maximum entropy, Nonparametric regression, Objective prior, Regression, Reproducing kernel, RKHS, Tikhonov regularization.

Abstract: The problem of estimating a parametric or nonparametric regression function in a model with normal errors is considered. For this purpose, a novel objective prior for the regression function is proposed, defined as the distribution maximizing entropy subject to a suitable constraint based on the Fisher information on the regression function. The prior is named I-prior. For the present model, it is Gaussian with covariance kernel proportional to the Fisher information, and mean chosen a priori (e.g., 0). The I-prior has the intuitively appealing property that the more information is available about a linear functional of the regression function, the larger its prior variance, and, broadly speaking, the less influential the prior is on the posterior. Unlike the Jeffreys prior, it can be used in high dimensional settings. The I-prior methodology can be used as a principled alternative to Tikhonov regularization, which suffers from well-known theoretical problems which are briefly reviewed. The regression function is assumed to lie in a reproducing kernel Hilbert space (RKHS) over a low or high dimensional covariate space, giving a high degree of generality. Analysis of some real data sets and a small-scale simulation study show competitive performance of the I-prior methodology, which is implemented in the R-package iprior.

[22] Huybrechts F. Bindele. "Covariates missing at random under signed-rank inference". In: *Econometrics and Statistics* 8 (2018), pp. 78 –93. DOI: https://doi.org/10.1016/j.ecosta.2018.05.002.

Keywords: Signed-rank norm, Ignorable missing, Inverse probability weighting and Simple imputations.

Abstract: A robust regression analysis in the presence of missing covariates is considered. The signed-rank estimator of the regression coefficients is studied, where the missing covariates are imputed under the assumption that they are missing at random. The consistency and asymptotic normality of the proposed estimator are established under mild conditions. Monte Carlo simulation experiments are carried out. They demonstrate that the signed-rank estimator is more efficient than the least squares and the least absolute deviations estimators whenever the error distribution is heavy tailed or contaminated. Under the standard normal model error distribution with well specified conditional distribution of the missing covariates, the least-squares and signed-rank methods provide similar results while the least absolute deviations method is inefficient. Finally, the use of the

proposed methodology is illustrated using the economic and political data on nine developing countries in Asia from 1980 to 1999.

[23] Peter Boswijk et al. “Special issue on time series econometrics”. In: *Econometrics and Statistics* 4 (2017), pp. 1 –2. DOI: https://doi.org/10.1016/j.ecosta.2017.05.004.

[24] Francesco Bravo, Ba M. Chu, and David T. Jacho-Chávez. “Generalized empirical likelihood M testing for semiparametric models with time series data”. In: *Econometrics and Statistics* 4 (2017), pp. 18 –30. DOI: https://doi.org/10.1016/j.ecosta.2016.12.004.
Keywords: -mixing, Instrumental variables, Kernel smoothing, Stochastic equicontinuity.
Abstract: The problem of testing for the correct specification of semiparametric models with time series data is considered. Two general classes of M test statistics that are based on the generalized empirical likelihood method are proposed. A test for omitted covariates in a semiparametric time series regression model is then used to showcase the results. Monte Carlo experiments show that the tests have reasonable size and power properties in finite samples. An application to the demand of electricity in Ontario (Canada) illustrates their usefulness in practice.

[25] Jörg Breitung and Sven Schreiber. “Assessing causality and delay within a frequency band”. In: *Econometrics and Statistics* 6 (2018). STATISTICS OF EXTREMES AND APPLICATIONS, pp. 57 –73. DOI: https://doi.org/10.1016/j.ecosta.2017.04.005.
Keywords: Granger causality, Frequency domain, Filter gain.
Abstract: The frequency-specific Granger causality test is extended to a more general null hypothesis that allows causality testing at unknown frequencies within a pre-specified range of frequencies. This setup corresponds better to empirical situations encountered in applied research and it is easily implemented in vector autoregressive models. Furthermore tools are provided to estimate and determine the sampling uncertainty of the phase shift/delay at some prespecified frequency or frequency band. In an empirical application dealing with the dynamics of CO2 emissions and US temperatures it is found that emissions cause temperature changes only at very low frequencies with more than 30 years of oscillation. In a business cycle application the causality and leading properties of new orders for German industrial production are analyzed at the interesting frequencies.

[26] Simon A. Broda, Jochen Krause, and Marc S. Paolella. "Approximating expected shortfall for heavy-tailed distributions". In: *Econometrics and Statistics* 8 (2018), pp. 184 –203. DOI: https://doi.org/10.1016/j.ecosta.2017.07.003.
Keywords: CDO pricing, Expectedshortfall, Mixture distributions, Portfolio optimization, Saddlepoint approximation, Stop-loss premium.
Abstract: A saddlepoint approximation for evaluating the expected shortfall of financial returns under realistic distributional assumptions is derived. This addresses a need that has arisen after the Basel Committee's proposed move from Value at Risk to expected shortfall as the mandated risk measure in its market risk framework. Unlike earlier results, the approximation does not require the existence of a moment generating function, and is therefore applicable to the heavy-tailed distributions prevalent in finance. A link is established between the proposed approximation and mean-expected shortfall portfolio optimization. Numerical examples include the noncentral t, generalized error, and α-stable distributions. A portfolio of DJIA stocks is considered in an empirical application.

[27] Donald Brown and Rustam Ibragimov. "Sign tests for dependent observations". In: *Econometrics and Statistics* 10 (2019), pp. 1 –8. DOI: https://doi.org/10.1016/j.ecosta.2018.11.001.
Keywords: Sign tests, Dependence, Adapted processes, Martingale-difference sequences, Conditional symmetry, Bernoulli random variables, Exact tests, Conservative tests.
Abstract: New sign tests for testing equality of conditional distributions of two (arbitrary) adapted processes as well as for testing conditionally symmetric martingale-difference assumptions are introduced. The analysis is based on results that demonstrate that randomization over ties in sign tests for equality of conditional distributions of two adapted sequences produces a stream of i.i.d. symmetric Bernoulli random variables. This reduces the problem of evaluating the critical values of the tests to computing the quantiles or moments of Binomial or normal distributions. Similar properties also hold under randomization over zero values of signs of a conditionally symmetric martingale-difference sequence.

[28] P. Burdejova et al. "Change point and trend analyses of annual expectile curves of tropical storms". In: *Econometrics and Statistics* 1 (2017), pp. 101 –117. DOI: https://doi.org/10.1016/j.ecosta.2016.09.002.

Keywords: Change point, Trend test, Tropical storms, Expectiles, Functional data analysis.
Abstract: Motivated by the conjectured existence of trends in the intensity of tropical storms, new inferential methodology to detect a trend in the annual pattern of environmental data is developed. It can be applied to any data which form a_time series of functions. Other examples include annual temperature or daily pollution curves at specific locations. Within a framework of a functional regression model, two tests of significance of the slope function are derived. One of the tests relies on a Monte Carlo distribution to compute the critical values, the other is pivotal with the chi–square limit distribution. Full asymptotic justification of both tests is provided. Their finite sample properties are investigated by a simulation study. Applied to tropical storm data, these tests show that there is a significant trend in the shape of the annual pattern of upper wind speed levels of hurricanes.

[29] Eva Cantoni and Xavier de Luna. "Semiparametric inference with missing data: Robustness to outliers and model misspecification". In: *Econometrics and Statistics* (2020). In press. DOI: https://doi.org/10.1016/j.ecosta.2020.01.003.
Keywords: average causal effects, doubly robust estimator, influence function, inverse probability weighting, outcome regression.
Abstract: Classical semiparametric inference with missing outcome data is not robust to contamination of the observed data and a single observation can have arbitrarily large influence on estimation of a parameter of interest. This sensitivity is exacerbated when inverse probability weighting methods are used, which may overweight contaminated observations. Inverse probability weighted, double robust and outcome regression estimators of location and scale parameters are introduced, which are robust to contamination in the sense that their influence function is bounded. Asymptotic properties are deduced and finite sample behaviour studied. Simulated experiments show that contamination can be more serious a threat to the quality of inference than model misspecification. An interesting aspect of the results is that the auxiliary outcome model used to adjust for ignorable missingness by some of the estimators, is also useful to protect against contamination. Both adjustment to ignorable missingness and protection against contamination are achieved through weighting schemes. A case study illustrates how the resulting weights

can be studied to gain insights on how the two different weighting schemes interact.

[30] Carolina Castagnetti, Eduardo Rossi, and Lorenzo Trapani. "A two-stage estimator for heterogeneous panel models with common factors". In: *Econometrics and Statistics* 11 (2019), pp. 63 –82. DOI: https://doi.org/10.1016/j.ecosta.2017.10.005.
Keywords: Large panels, Factor error structure, Principal components, Common regressors, Cross-section dependence.
Abstract: The estimation in a stationary heterogeneous panel model where unknown common factors are present is considered. A two-stage estimator is proposed and compared to existing alternative methods for the estimation of slope parameters in panels with a multifactor error structure. The asymptotic properties of this estimator are provided alongside the comparison of its finite-sample properties with those of a range of estimators by means of Monte Carlo experiments. The two-stage estimator affords a greater computational simplicity with respect to existing iterative estimators that fail to achieve convergence in a relevant number of cases considered. The proposed estimator is employed in the analysis of the determinants of Euro-denominated bonds in a framework of a heterogeneous panel data model with multifactor error structure.

[31] P.S. Catani and N.J.C. Ahlgren. "Combined Lagrange multiplier test for ARCH in vector autoregressive models". In: *Econometrics and Statistics* 1 (2017), pp. 62 –84. DOI: https://doi.org/10.1016/j.ecosta.2016.10.006.
Keywords: ARCH, Bootstrap, Lagrange multiplier test, Monte Carlo test, VAR model.
Abstract: A combined Lagrange multiplier (LM) test for autoregressive conditional heteroskedastic (ARCH) errors in vector autoregressive (VAR) models is proposed by replacing an exact Monte Carlo (MC) test by a bootstrap MC test when the model includes lags. The test circumvents the problem of high dimensionality in multivariate tests for ARCH in VAR models. It only requires computing univariate statistics. A computational advantage is therefore that the number of parameters to be estimated is independent of the dimension of the VAR process. The bootstrap MC test is shown to be asymptotically valid. Monte Carlo simulations show that the test has good finite-sample properties. The test is robust against a non-normal error distribution. Two financial applications of multivariate LM tests

for ARCH to credit default swap (CDS) prices and Euribor interest rates are presented. The results indicate that the errors are skewed and heavy-tailed, and that there are significant ARCH effects.

[32] Hao Chai et al. “Identifying gene-environment interactions for prognosis using a robust approach”. In: *Econometrics and Statistics* 4 (2017), pp. 105 –120. DOI: https://doi.org/10.1016/j.ecosta.2016.10.004.

Keywords: Gene-environment interaction, Prognosis, Robustness, Exponential squared loss, Marker identification.

Abstract: For many complex diseases, prognosis is of essential importance. It has been shown that, beyond the main effects of genetic (G) and environmental (E) risk factors, gene-environment (G $\times$ E) interactions also play a critical role. In practical data analysis, part of the prognosis outcome data can have a distribution different from that of the rest of the data because of contamination or a mixture of subtypes. Literature has shown that data contamination as well as a mixture of distributions, if not properly accounted for, can lead to severely biased model estimation. In this study, we describe prognosis using an accelerated failure time (AFT) model. An exponential squared loss is proposed to accommodate data contamination or a mixture of distributions. A penalization approach is adopted for regularized estimation and marker selection. The proposed method is realized using an effective coordinate descent (CD) and minorization maximization (MM) algorithm. The estimation and identification consistency properties are rigorously established. Simulation shows that without contamination or mixture, the proposed method has performance comparable to or better than the nonrobust alternative. However, with contamination or mixture, it outperforms the nonrobust alternative and, under certain scenarios, is superior to the robust method based on quantile regression. The proposed method is applied to the analysis of TCGA (The Cancer Genome Atlas) lung cancer data. It identifies interactions different from those using the alternatives. The identified markers have important implications and satisfactory stability.

[33] Vaidotas Characiejus and Gregory Rice. “A general white noise test based on kernel lag-window estimates of the spectral density operator”. In: *Econometrics and Statistics* 13 (2020), pp. 175 –196. DOI: https://doi.org/10.1016/j.ecosta.2019.01.003.

Keywords: time series, functional data, serial correlation, spectral density operator, kernel estimator.
Abstract: A general white noise test for functional time series is considered. The idea of the test is to estimate a distance between the spectral density operator of a weakly stationary time series and the constant spectral density operator of an uncorrelated time series. The estimator of the distance is based on a kernel lag-window type estimator of the spectral density operator. When the observed time series is a strong white noise in a real separable Hilbert space, it is shown that the asymptotic distribution of the test statistic is standard normal, and it is further shown that the test statistic diverges for general serially correlated time series. These results recover as special cases some previous tests. In order to implement the test, a number of kernel and bandwidth choices is proposed and studied, including a new data adaptive bandwidth, as well as data adaptive power transformations of the test statistic that improve the normal approximation in finite samples. A simulation study demonstrated that the proposed method has good size and improved power when compared to other methods available in the literature, while also offering a light computational burden.

[34] Taeryon Choi et al. "Special issue on Bayesian methods in statistics and econometrics". In: *Econometrics and Statistics* 3 (2017), pp. 1 –2. DOI: https://doi.org/10.1016/j.ecosta.2017.05.003.

[35] Ilias Chronopoulos, George Kapetanios, and Katerina Petrova. "Kernel-based Volatility Generalised Least Squares". In: *Econometrics and Statistics* (2019). In press. DOI: https://doi.org/10.1016/j.ecosta.2019.11.001.
Keywords: Heteroskedasticity, Stochastic volatility, Weighted least squares.
Abstract: The problem of inference in a standard linear regression model with heteroskedastic errors is investigated. A GLS estimator which is based on a nonparametric kernel estimator is proposed for the volatility process. It is shown that the resulting feasible GLS estimator is T-consistent for a wide range of deterministic and stochastic processes for the time-varying volatility. Moreover, the kernel-GLS estimator is asymptotically more efficient than OLS and hence inference based on its asymptotic distribution is sharper. A Monte Carlo exercise is designed to study the finite sample properties of the proposed estimator and it is shown that tests based on it are correctly-sized for

a variety of DGPs. As expected, it is found that in some cases, testing based on OLS is invalid. Crucially, even in cases when tests based on OLS or OLS with heteroskedasticity-consistent (HC) standard errors are correctly-sized, it is found that inference based on the proposed GLS estimator is more powerful even for relatively small sample sizes.

[36] Fabrizio Cipollini and Giampiero M. Gallo. "Modeling Euro STOXX 50 volatility with common and market-specific components". In: *Econometrics and Statistics* 11 (2019), pp. 22 –42. DOI: https://doi.org/10.1016/j.ecosta.2018.09.004.

Keywords: Realized volatility, (vector) Multiplicative Error Models, GMM, HAR, Common component, Euro area.

Abstract: Similar volatility patterns are observables in the Euro area across national indices, suggesting the possibility of an underlying common component as a consequence of financial and monetary integration. This peculiar interdependence across market volatilities is captured by an additive component vector Multiplicative Error Model (vMEM) where the volatility dynamics is split between a common and a vector of market-specific components. When extracted from five major market indices and used as additional regressors in a HAR specification for the Euro STOXX 50 (a Euro area wide index) volatility, these components replace the terms that mimic long memory in the HAR, providing an interesting interpretation for volatility dynamics.

[37] Roberto Colombi. "Selection tests for possibly misspecified hierarchical multinomial marginal models". In: *Econometrics and Statistics* (2019). In press. DOI: https://doi.org/10.1016/j.ecosta.2019.06.002.

Keywords: Contingency tables, Marginal models for categorical data, Misspecified models, Model selection, Maximum likelihood estimation, Quadratic forms in normal variables.

Abstract: Hierarchical marginal models have been proposed for categorical data to overcome some limitations of the log-linear approach in modeling marginal distributions. These models can easily satisfy marginal conditional independence conditions and describe with great flexibility the dependence of marginal distributions on covariates. As the richness of the family of hierarchical marginal models leads to comparing models that do not satisfy a nesting relationship, statistical tests for model selection from non-nested, possibly misspecified marginal models are introduced.

[38] Michael Creel. “Neural nets for indirect inference”. In: *Econometrics and Statistics* 2 (2017), pp. 36 –49. DOI: https://doi.org/10.1016/j.ecosta.2016.11.008.
Keywords: Neural networks, Indirect inference, Approximate Bayesian computing, Machine learning, DSGE, Jump-diffusion.
Abstract: For simulable models, neural networks are used to approximate the limited information posterior mean, which conditions on a vector of statistics, rather than on the full sample. Because the model is simulable, training and testing samples may be generated with sizes large enough to train well a net that is large enough, in terms of number of hidden layers and neurons, to learn the limited information posterior mean with good accuracy. Targeting the limited information posterior mean using neural nets is simpler, faster, and more successful than is targeting the full information posterior mean, which conditions on the observed sample. The output of the trained net can be used directly as an estimator of the model's parameters, or as an input to subsequent classical or Bayesian indirect inference estimation. The methods are illustrated with applications to a small dynamic stochastic general equilibrium model and a continuous time jump-diffusion model for stock index returns.

[39] Imma Valentina Curato, Maria Elvira Mancino, and Maria Cristina Recchioni. “Spot volatility estimation using the Laplace transform”. In: *Econometrics and Statistics* 6 (2018). STATISTICS OF EXTREMES AND APPLICATIONS, pp. 22 –43. DOI: https://doi.org/10.1016/j.ecosta.2016.07.002.
Keywords: Laplace transform, Convolution, Spot volatility, Non-parametric estimation, High frequency data, Microstructure noise.
Abstract: A new non-parametric estimator of the instantaneous volatility is defined relying on the link between the Laplace transform of the price process and that of the volatility process for Brownian semimartingale models. The proposed estimation method is a global one, in the spirit of methods based on Fourier series decomposition, with a plus for improving the precision of the volatility estimates near the boundary of the time interval. Consistency and asymptotic normality of the proposed estimator are proved. A simulation study confirms the theoretical results and Monte Carlo evidence of the favorable performance of the proposed estimator in the presence of microstructure noise effects is presented.

[40] Claudia Czado, Eugen Ivanov, and Yarema Okhrin. “Modelling tem-

poral dependence of realized variances with vines". In: *Econometrics and Statistics* 12 (2019), pp. 198 –216. DOI: https://doi.org/10.1016/j.ecosta.2019.03.003.
Keywords: Vines, Realized volatility, Forecasting, Time series.
Abstract: Models for realized volatility that take the specific form of temporal dependence into account are proposed. Current popular methods use the idea of mixed frequencies for forecasting realized volatility, but neglect the potential non-linear and non-monotonic temporal dependence. The proposed approach utilizes vine copulas to mimic different memory properties. HAR, MIDAS and bivariate copulas, which can be seen as special cases of the suggested modeling framework, are chosen as benchmarks. All models are evaluated within an extensive empirical study both in- and out-of-sample and their forecasting ability is compared statistically. The results suggest that one specific vine copula construction is significantly superior over the considered benchmarks in modeling time dependencies of realized volatilities.

[41] Robert L. Czudaj. "Dynamics between trading volume, volatility and open interest in agricultural futures markets: A Bayesian time-varying coefficient approach". In: *Econometrics and Statistics* 12 (2019), pp. 78 –145. DOI: https://doi.org/10.1016/j.ecosta.2019.05.002.
Keywords: Agricultural futures markets, Open interest, Time-varying Bayesian VAR, Trading volume, Volatility.
Abstract: The dynamics between trading volume and volatility for seven agricultural futures markets are examined by drawing on the large literature for equity markets and by allowing for heterogeneity of investors beliefs proxied by open interest. In addition, time-varying effects on the transmission mechanism of shocks are also accounted for by implementing a Bayesian VAR model, which allows for time-variation stemming from both the coefficients and the variance covariance structure of the model's disturbances. This is important since it accounts for changes in the number of trades and the size of trades across different periods, which can have different effects on the volatility-volume relation. The results show that the Granger causality and the reaction to shocks varies substantially over time. This highlights the importance to allow for time-variation when modeling the relationship between volatility, trading volume and open interest for agricultural futures markets. In general, the findings indicate

that volatility of agricultural futures markets is driven by previous period's trading volume and open interest. However, the reversed relationship from lagged volatility to trading volume and open interest is limited to certain periods of time.

[42] Ning Dai, Galin L. Jones, and Mark Fiecas. "Bayesian longitudinal spectral estimation with application to resting-state fMRI data analysis". In: *Econometrics and Statistics* (2019). In press. DOI: https://doi.org/10.1016/j.ecosta.2019.01.002.
Keywords: Resting-state fMRI, Longitudinal data analysis, Spectral estimation, Alzheimer's disease, Amplitude of low-frequency fluctuation, Markov chain Monte Carlo.
Abstract: The amplitude of the oscillatory patterns present in spontaneous fluctuations of brain signals obtained from resting-state functional magnetic resonance imaging (fMRI), measured using an index called the fractional amplitude of low-frequency fluctuation (fALFF), is a well-known measure of brain activity with potential to serve as a marker for brain dysfunction. With the rise of longitudinal neuroimaging studies, there is a great need for methodologies that take advantage of the longitudinal design in modeling the impact of aging or disease progression. Motivated by the longitudinal design of the Alzheimer's Disease Neuroimaging Initiative (ADNI), a novel Bayesian longitudinal model is developed in order to estimate the spectra of resting-state fMRI time courses, from which one can extract estimates of fALFF that are potentially associated with aging. The model incorporates within-subject correlation to improve estimates of the spectra, in addition to the variability that naturally arises between subjects. The model is validated using simulated data to show the gains in performance for estimating fALFF by taking advantage of the longitudinal design. Finally, a longitudinal analysis on fALFF from the resting-state fMRI data from ADNI is conducted, where the impact of both Alzheimer's disease and aging on the spontaneous fluctuations of brain activity is shown.

[43] Abdelaati Daouia, Jean-Pierre Florens, and Léopold Simar. "Robust frontier estimation from noisy data: A Tikhonov regularization approach". In: *Econometrics and Statistics* 14 (2020), pp. 1 –23. DOI: https://doi.org/10.1016/j.ecosta.2018.07.003.
Keywords: Deconvolution, Nonparametric estimation, Probability-weighted moment, Production function, Robustness, Stochastic frontier, Tikhonov regularization.

Abstract: In stochastic frontier models, the regression function defines the production frontier and the regression errors are assumed to be composite. The actually observed outputs are assumed to be contaminated by a stochastic noise. The additive regression errors are composed from this noise term and the one-sided inefficiency term. The aim is to construct a robust nonparametric estimator for the production function. The main tool is a robust concept of partial, expected maximum production frontier, defined as a special probability-weighted moment. In contrast to the deterministic one-sided error model where robust partial frontier modeling is fruitful, the composite error problem requires a substantial different treatment based on deconvolution techniques. To ensure the identifiability of the model, it is sufficient to assume an independent Gaussian noise. In doing so, the frontier estimation necessitates the computation of a survival function estimator from an ill-posed equation. A Tikhonov regularized solution is constructed and nonparametric frontier estimation is performed. The asymptotic properties of the obtained survival function and frontier estimators are established. Practical guidelines to effect the necessary computations are described via a simulated example. The usefulness of the approach is discussed through two concrete data sets from the sector of Delivery Services.

[44] Rembert De Blander. "Iterative estimation correcting for error autocorrelation in short panels, applied to lagged dependent variable models". In: *Econometrics and Statistics* (2020). In press. DOI: https://doi.org/10.1016/j.ecosta.2020.02.001.

Keywords: Correlated individual-specific effects, Iterative estimation, Lagged dependent variables, Panel data, Serial error correlation.

Abstract: An iterative estimation procedure incorporating error serial correlation in short panels is presented. Neglecting serial correlation might both result in inconsistent variance estimates and in inconsistent parameter estimates, for example in (structural) models containing (functions of) lagged dependent variables. Lagged disturbances and/or lagged innovations are treated as unobserved or latent variables, and their estimates are included as supplementary regressors. Iterating until convergence results in consistent estimates of all model parameters. In addition, the asymptotic distribution of the proposed estimator, which can accommodate auto-regressive errors without any assumptions regarding starting values is presented. The main advantage of the proposed method is the maximal reuse of ex-

isting (cross-sectional) code, which can simply be adapted to serially correlated disturbances. As such, this "quick fix" estimator seems to be a promising avenue for applied researchers suspecting serial correlation in their data, but only willing to perform a moderate amount of coding (i.e. the iterative loop & the adaptation of the variance estimation), without having to develop, code and debug a full own model. The proposed method is applied to panel data models with lagged dependent variables with and without fixed effects.

[45] Cees de Valk and Juan-Juan Cai. "A high quantile estimator based on the log-generalized Weibull tail limit". In: *Econometrics and Statistics* 6 (2018). STATISTICS OF EXTREMES AND APPLICATIONS, pp. 107 –128. DOI: https://doi.org/10.1016/j.ecosta.2017.03.001.

Keywords: High quantile, Hill estimator, Log-generalized Weibull tail limit, Log-GW tail index.

Abstract: The estimation of high quantiles for very low probabilities of exceedance pn much smaller than 1/n (with n the sample size) remains a major challenge. For this purpose, the log-Generalized Weibull (log-GW) tail limit was recently proposed as regularity condition as an alternative to the Generalized Pareto (GP) tail limit, in order to avoid potentially severe bias in applications of the latter. Continuing in this direction, a new estimator for the log-GW tail index and a related quantile estimator are introduced. Both are constructed using the Hill estimator as building block. Sufficient conditions for asymptotic normality are established. These results, together with the results of simulations and an application, indicate that the new estimator fulfils the potential of the log-GW tail limit as a widely applicable model for high quantile estimation, showing a substantial reduction in bias as well as improved precision when compared to an estimator based on the GP tail limit.

[46] Manfred Deistler, Lukas Koelbl, and Brian D.O. Anderson. "Non-identifiability of VMA and VARMA systems in the mixed frequency case". In: *Econometrics and Statistics* 4 (2017), pp. 31 –38. DOI: https://doi.org/10.1016/j.ecosta.2016.11.006.

Keywords: VARMA, VMA, Mixed frequency, Non-identifiability.

Abstract: Recently, identifiability results for VAR systems in the context of mixed frequency data have been shown in a number of papers. These results have been extended to VARMA systems, where the MA order is smaller than or equal to the AR order. Here, it is

shown that in the VMA case and in the VARMA case, where the MA order exceeds the AR order, results are completely different. Then, for the case, where the innovation covariance matrix is non-singular, "typically" non-identifiability occurs – not even local identifiability. This is due to the fact that, e.g., in the VMA case, as opposed to the VAR case, the not directly observed autocovariances of the output can vary "freely". In the singular case, i.e., when the innovation covariance matrix is singular, things may be different.

[47] Cyrus J. DiCiccio, Joseph P. Romano, and Michael Wolf. "Improving weighted least squares inference". In: *Econometrics and Statistics* 10 (2019), pp. 96 –119. DOI: https://doi.org/10.1016/j.ecosta.2018.06.005.

Keywords: Bootstrap, Conditional heteroskedasticity, HC standard errors.

Abstract: These days, it is common practice to base inference about the coefficients in a hetoskedastic linear model on the ordinary least squares estimator in conjunction with using heteroskedasticity consistent standard errors. Even when the true form of heteroskedasticity is unknown, heteroskedasticity consistent standard errors can also used to base valid inference on a weighted least squares estimator and using such an estimator can provide large gains in efficiency over the ordinary least squares estimator. However, intervals based on asymptotic approximations with plug-in standard errors often have coverage that is below the nominal level, especially for small sample sizes. Similarly, tests can have null rejection probabilities that are above the nominal level. It is shown that under unknown hereroskedasticy, a bootstrap approximation to the sampling distribution of the weighted least squares estimator is valid, which allows for inference with improved finite-sample properties. For testing linear constraints, permutations tests are proposed which are exact when the error distribution is symmetric and is asymptotically valid otherwise. Another concern that has discouraged the use of weighting is that the weighted least squares estimator may be less efficient than the ordinary least squares estimator when the model used to estimate the unknown form of the heteroskedasticity is misspecified. To address this problem, a new estimator is proposed that is asymptotically at least as efficient as both the ordinary and the weighted least squares estimator. Simulation studies demonstrate the attractive finite-sample properties

of this new estimator as well as the improvements in performance realized by bootstrap confidence intervals.

[48] Chrysoula Dimitriou-Fakalou. "On accepting the edge-effect (for the inference of ARMA-type processes in Z2)". In: *Econometrics and Statistics* 10 (2019), pp. 53 –70. DOI: https://doi.org/10.1016/j.ecosta.2018.03.001.
Keywords: Bias, Edge-effects, Point estimation, Weighted least squares.
Abstract: The edge-effect interrupts the theory of (weakly) stationary processes indexed in the (infinite) two-dimensional lattice. The bias of the maximum likelihood estimators (with asymptotics increasing on both sides), does not seemingly tend to zero faster than their standard error. To deal with it, weights are applied on the computable innovations, such that all the contributions of the same bias are squeezed to become equivalent to that of one observation. As a result, the edge-effect appearance in the form of the speed of the estimators' bias (to a finite bound) following the augmentation of observations on one axis only, becomes the base for the new solution to the problem. What remains to be seen, is how these weights affect other properties, such as the asymptotic distribution and variance of the proposed estimators.

[49] Sebastian Döhler. "A discrete modification of the Benjamini–Yekutieli procedure". In: *Econometrics and Statistics* 5 (2018), pp. 137 –147. DOI: https://doi.org/10.1016/j.ecosta.2016.12.002.
Keywords: False discovery rate, Multiple testing, Discrete data.
Abstract: The Benjamini–Yekutieli procedure is a multiple testing method that controls the false discovery rate under arbitrary dependence of the p-values. A modification of this and related procedures is proposed for the case when the test statistics are discrete. It is shown that taking discreteness into account can improve upon known procedures. The performance of this new procedure is evaluated for pharmacovigilance data and in a simulation study.

[50] Shoichi Eguchi. "Model comparison for generalized linear models with dependent observations". In: *Econometrics and Statistics* 5 (2018), pp. 171 –188. DOI: https://doi.org/10.1016/j.ecosta.2017.04.003.
Keywords: Asymptotic Bayesian model comparison, Quasi-likelihood, Dependent data, Model misspecification, Generalized linear model.
Abstract: The stochastic expansion of the marginal quasi-likelihood function associated with a class of generalized linear models is shown.

Based on the expansion, a quasi-Bayesian information criterion is proposed that is able to deal with misspecified models and dependent data, resulting in a theoretical extension of the classical Schwarz's Bayesian information criterion. It is also proved that the proposed criterion has model selection consistency with respect to the optimal model. Some illustrative numerical examples and a real data example are presented.

[51] Jonathan El Methni and Gilles Stupfler. "Improved estimators of extreme Wang distortion risk measures for very heavy-tailed distributions". In: *Econometrics and Statistics* 6 (2018). STATISTICS OF EXTREMES AND APPLICATIONS, pp. 129 –148. DOI: https://doi.org/10.1016/j.ecosta.2017.03.002.
Keywords: Asymptotic normality, Extreme value statistics, Heavy-tailed distribution, Trimming, Wang distortion risk measure, Winsorising.
Abstract: A general way to study the extremes of a random variable is to consider the family of its Wang distortion risk measures. This class of risk measures encompasses several indicators such as the classical quantile/Value-at-Risk, the Tail-Value-at-Risk and Conditional Tail Moments. Trimmed and winsorised versions of the empirical counterparts of extreme analogues of Wang distortion risk measures are considered. Their asymptotic properties are analysed, and it is shown that it is possible to construct corrected versions of trimmed or winsorised estimators of extreme Wang distortion risk measures who appear to perform overall better than their standard empirical counterparts in difficult finite-sample situations when the underlying distribution has a very heavy right tail. This technique is showcased on a set of real fire insurance data.

[52] Zhaohu Fan and Matthew Reimherr. "High-dimensional adaptive function-on-scalar regression". In: *Econometrics and Statistics* 1 (2017), pp. 167 –183. DOI: https://doi.org/10.1016/j.ecosta.2016.08.001.
Keywords: Variable selection, Functional regression, Oracle property.
Abstract: Applications of functional data with large numbers of predictors have grown precipitously in recent years, driven, in part, by rapid advances in genotyping technologies. Given the large numbers of genetic mutations encountered in genetic association studies, statistical methods which more fully exploit the underlying structure of the data are imperative for maximizing statistical power. However,

there is currently very limited work in functional data with large numbers of predictors. Tools are presented for simultaneous variable selection and parameter estimation in a functional linear model with a functional outcome and a large number of scalar predictors; the technique is called AFSL for Adaptive Function-on-Scalar Lasso. It is demonstrated how techniques from convex analysis over Hilbert spaces can be used to establish a functional version of the oracle property for AFSL over any real separable Hilbert space, even when the number of predictors, I, is exponentially large compared to the sample size, N. AFSL is illustrated via a simulation study and data from the Childhood Asthma Management Program, CAMP, selecting those genetic mutations which are important for lung growth.

[53] Maria Brigida Ferraro, Paolo Giordani, and Maurizio Vichi. "A class of two-mode clustering algorithms in a fuzzy setting". In: *Econometrics and Statistics* (2020). In press. DOI: https://doi.org/10.1016/j.ecosta.2020.03.006.

Keywords: Two-mode clustering, Fuzzy clustering, Polynomial fuzzifiers, Noise cluster.

Abstract: Two-mode clustering consists in simultaneously partitioning modes (e.g., objects and variables) of an observed two-mode data matrix. A class of two-mode clustering algorithms in a fuzzy framework is proposed. Starting from the Double k-Means algorithm, different fuzzy proposals are addressed. The first one is the Fuzzy Double k-Means (FDkM) algorithm, providing two fuzzy partitions, one for each mode. A second proposal is the Fuzzy Double k-Means with polynomial fuzzifiers (FDkMpf) algorithm, a general method that includes the FDkM one as a particular case. Finally, a robust extension is introduced and analyzed by using the concept of noise cluster. The adequacy of the proposed algorithms is checked by means of a simulation and two real-case studies.

[54] Frédéric Ferraty, Anthony Zullo, and Mathieu Fauvel. "Nonparametric regression on contaminated functional predictor with application to hyperspectral data". In: *Econometrics and Statistics* 9 (2019), pp. 95 –107. DOI: https://doi.org/10.1016/j.ecosta.2017.02.004.

Keywords: Errors-in-variables, Functional data, High-dimensional setting, Hyperspectral image, Nonparametric functional regression, Random curve, Remote sensing, Supervised classification.

Abstract: Regressing nonparametrically a scalar response on a contaminated random curve observed at some measurement grid may be a hard task. To address this common statistical situation, a kernel presmoothing step is achieved on the noisy functional predictor. After that, the kernel estimator of the regression operator is built using the smoothed functional covariate instead of the original corrupted one. The rate of convergence is stated for this nested-kernel estimator with special attention to high-dimensional setting (i.e. the size of the measurement grid is much larger than the sample size). The proposed method is applied to simulated datasets in order to assess its finite-sample properties. Our methodology is further illustrated on a real hyperspectral dataset involving a supervised classification problem.

[55] Silvia Figini, Mario Maggi, and Pierpaolo Uberti. "The market rank indicator to detect financial distress". In: *Econometrics and Statistics* 14 (2020), pp. 63 –73. DOI: https://doi.org/10.1016/j.ecosta.2017.12.001.

Keywords: Risk analysis, Systemic risk, Financial crises.

Abstract: A novel measure is introduced to forecast financial crises, which can also be seen as a supplementary measure in systemic risk analysis. The indicator (the market rank indicator MRI) considers the relation between the largest singular value of a matrix of the return time series and its k smallest singular values. The rationale behind this is that, in times of market excitation and higher correlation, the vectors of the return time series become closer in the linear space containing them. The MRI is related to the notion of condition number, a measure of how close returns are; therefore, the MRI increases in periods of market tensions. The measure is applied to selected stock market indexes and tested empirically for its sensitivity as well as against alternative measures of systemic risk. The MRI could be of interest for both regulators and speculators due to its forecasting power. The empirical analysis underlines that the proposed methodology is particularly appealing to forecast market distress and it shows a clear superiority in terms of predictive capability with respect to other existing measures.

[56] Thomai Filippeli, Richard Harrison, and Konstantinos Theodoridis. "DSGE-based priors for BVARs and quasi-Bayesian DSGE estimation". In: *Econometrics and Statistics* (2019). In press. DOI: https://doi.org/10.1016/j.ecosta.2018.12.002.

Keywords: BVAR, SVAR, DSGE, DSGE–VAR, Gibbs sampling, Marginal likelihood evaluation, Predictive likelihood evaluation, Quasi-Bayesian DSGE estimation.
Abstract: A new method for estimating Bayesian vector autoregression (VAR) models using priors from a dynamic stochastic general equilibrium (DSGE) model is presented. The DSGE model priors are used to determine the moments of an independent Normal-Wishart prior for the VAR parameters. Two hyper-parameters control the tightness of the DSGE-implied priors on the autoregressive coefficients and the residual covariance matrix respectively. Selecting the values of the hyper-parameters that maximize the marginal likelihood of the Bayesian VAR provides a method for isolating subsets of DSGE parameter priors that are at odds with the data. The ability of the new method to correctly detect misspecified DSGE priors is illustrated using a Monte Carlo experiment. The method gives rise to a new 'quasi-Bayesian' estimation approach: posterior estimates of the DSGE parameter vector can be recovered from the BVAR posterior estimates. An empirical application on US data reveals economically meaningful differences in posterior parameter estimates when comparing the quasi-Bayesian estimator with Bayesian maximum likelihood. The new method also indicates that the DSGE prior implications for the residual covariance matrix are at odds with the data.

[57] Kostas Florios. "A hyperplanes intersection simulated annealing algorithm for maximum score estimation". In: *Econometrics and Statistics* 8 (2018), pp. 37 –55. DOI: https://doi.org/10.1016/j.ecosta.2017.03.005.
Keywords: Maximum score estimator, Simulated annealing, Hyperplanes intersection, Local search, Comparative analysis, Metaheuristics.
Abstract: A new hyperplanes intersection simulated annealing (HISA) algorithm, based on a discrete representation of the search space as a combinatorial set of hyperplanes intersections, is developed for maximum score estimation of the binary choice model. As a prerequisite of the discrete space simulated annealing algorithm, also, a multi-start Hyperplanes Intersection Local Search algorithm (HILS) is devised. The implementation of the local search and simulated annealing algorithms searches the space of hyperplanes intersections combinations formulated by the regression's observations. A set of attributes that are equivalent to the hyperplanes whose intersections define poten-

tial maxima is selected as the solution representation. A swap move is introduced so that starting from an arbitrary set of attributes, nearby sets of attributes are generated and evaluated either using the steepest ascent or the Metropolis criterion. Applications include a work-trip mode choice application, for which the global optimum is known, and two labor force participation datasets with unknown global optima. Comparison is made to leading heuristic and metaheuristic approaches as well as to Mixed Integer Programming. Results show that multi-start HILS and especially HISA offer the best results for the two labor force participation datasets, and also discover the global optimum in the work-trip mode choice application.

[58] Konstantinos Fokianos and Theodoros Moysiadis. "Binary time series models driven by a latent process". In: *Econometrics and Statistics* 2 (2017), pp. 117 –130. DOI: https://doi.org/10.1016/j.ecosta.2017.02.001.

Keywords: Autocorrelation, Generalized linear models, Logistic model, Probit model, Regression, Weak dependence.

Abstract: The problem of ergodicity, stationarity and maximum likelihood estimation is studied for binary time series models that include a latent process. General models are considered, covered by different specifications of a link function. Maximum likelihood estimation is discussed and it is shown that the MLE satisfies standard asymptotic theory. The logistic and probit models, routinely employed for the analysis of binary time series data, are of special importance in this study. The results are applied to simulated and real data.

[59] Lendie Follett and Cindy Yu. "Achieving parsimony in Bayesian vector autoregressions with the horseshoe prior". In: *Econometrics and Statistics* 11 (2019), pp. 130 –144. DOI: https://doi.org/10.1016/j.ecosta.2018.12.004.

Keywords: MCMC, Shrinkage, Sparsity, Bayesian VAR, Macroeconomic forecasting.

Abstract: In the context of a vector autoregression (VAR) model, or any multivariate regression model, the number of relevant predictors may be small relative to the information set that is available. It is well known that forecasts based on (un-penalized) least squares estimates can overfit the data and lead to poor predictions. Since the Minnesota prior was proposed, there have been many methods developed aiming at improving prediction performance. The horseshoe

prior is proposed in the context of a Bayesian VAR. The horseshoe prior is a unique shrinkage prior scheme in that it shrinks irrelevant signals rigorously to 0 while allowing large signals to remain large and practically unshrunk. In an empirical study, it is shown that the horseshoe prior competes favorably with shrinkage schemes commonly used in Bayesian VAR models as well as with a prior that imposes true sparsity in the coefficient vector. Additionally, the use of particle Gibbs with backwards simulation is proposed for the estimation of the time-varying volatility parameters. A detailed description of relevant MCMC methods is provided in the supplementary material.

[60] Charles Fontaine, Ron D. Frostig, and Hernando Ombao. "Modeling non-linear spectral domain dependence using copulas with applications to rat local field potentials". In: *Econometrics and Statistics* (2019). In press. DOI: https://doi.org/10.1016/j.ecosta.2019.06.003.

Keywords: Changepoints, Dependence, Fourier transform, Parametric copulas, Spectral domain, Vine copulas.

Abstract: Tools for characterizing non-linear spectral dependence between spontaneous brain signals are developed, based on the use of parametric copula models (both bivariate and vine models) applied on the magnitude of Fourier coefficients rather than using coherence. The motivation is an experiment on rats that studied the impact of stroke on the connectivity structure (dependence) between local field potentials recorded by various microelectrodes. The following major questions are addressed. The first is to determine changepoints in the regime within a microelectrode for a given frequency band based on a difference between the cumulative distribution functions modeled for each epoch (small window of time). The proposed approach is an iterative algorithm which compares each successive bivariate copulas on all the epochs range, using a bivariate Kolmogorov–Smirnov statistic. The second is to determine if such changes are present only in some microelectrodes versus generalized across the entire network. These issues are addressed by comparing Vine-copulas models fitted for each epoch. The necessary framework is provided and the effectiveness of the methods is shown through the results for the local field potential data analysis of a rat.

[61] Antonio Forcina. "A Fisher-scoring algorithm for fitting latent class models with individual covariates". In: *Econometrics and Statistics*

3 (2017), pp. 132 –140. DOI: https://doi.org/10.1016/j.ecosta.2016.07.001.
Keywords: Categorical data analysis, EM algorithms, Empirical information matrix, Fisher scoring algorithms, Individual covariates, Latent class models, Line search, multinomial logit.
Abstract: Describes a modified Fisher scoring algorithm for fitting a wide variety of latent class models for categorical responses when both the class weights and the conditional distributions of the responses depend on individual covariates through a multinomial logit. A simple expression for computing the score vector and the empirical information matrix is presented; it is shown that this matrix is positive definite under mild conditions. The Fisher scoring algorithm combines the empirical information matrix to update the step direction with a line search to optimize the step length. The algorithm converges for almost any choice of starting values. An application to the field of education transmission seems to suggest that, while parents' education affects the child latent ability, their pressure affects directly the child's achievements.

[62] Benedikt Funke and Masayuki Hirukawa. "Nonparametric estimation and testing on discontinuity of positive supported densities: a kernel truncation approach". In: *Econometrics and Statistics* 9 (2019), pp. 156 –170. DOI: https://doi.org/10.1016/j.ecosta.2017.07.006.
Keywords: Density estimation, Discontinuous probability density, Gamma kernel, Incomplete gamma functions, Nonparametric kernel testing, Regression discontinuity design.
Abstract: Discontinuity in density functions is of economic importance and interest. For instance, in studies on regression discontinuity designs, discontinuity in the density of a running variable suggests violation of the no-manipulation assumption. In line with this notion, estimation and testing procedures on discontinuity in densities with positive support are developed. The proposed approach is built on splitting the asymmetric, gamma kernel into two parts at a prespecified cutoff that is suspected to be a discontinuity point and constructing two truncated kernels. The jump-size magnitude of the density at the cutoff can be estimated nonparametrically by two kernels and a multiplicative bias correction method. The estimator is easy to implement, and its convergence properties are delivered by various approximation techniques on incomplete gamma functions. Based on

the jump-size estimator, two versions of test statistics for the null of continuity at a given cutoff are also proposed. Moreover, estimation theory of the entire density in the presence of a discontinuity point is explored. Monte Carlo simulations confirm nice finite-sample properties of the jump-size estimator and the test statistics.

[63] Benedikt Funke and Masayuki Hirukawa. "Bias correction for local linear regression estimation using asymmetric kernels via the skewing method". In: *Econometrics and Statistics* (2020). In press. DOI: https://doi.org/10.1016/j.ecosta.2020.01.004.
Keywords: Beta kernel, Bias correction, Boundary bias, Curve estimation, Gamma kernel, Local linear regression estimation.
Abstract: The skewing method, which has been originally proposed as a bias correction device for local linear regression estimation using standard symmetric kernels, is extended to the cases of asymmetric kernels. The method is defined as a convex combination of three local linear estimators. It is demonstrated that the skewed estimator using asymmetric kernels with properly chosen weights can accelerate the bias convergence from O(b) to O(b2) as $b \to 0$ under sufficient smoothness of the unknown regression curve while not inflating the variance in an order of magnitude, where b is the smoothing parameter and the regressor is assumed to have at least one boundary. As a consequence, the estimator has optimal pointwise convergence of n-4/9 when best implemented, where n is the sample size. It is noteworthy that these properties are the same as those for a local cubic regression estimator. Finite-sample properties of the skewed estimator are assessed in comparison with local linear and local cubic estimators. An application of the skewed estimation to real data is also considered.

[64] Marco Gambacciani and Marc S. Paolella. "Robust normal mixtures for financial portfolio allocation". In: *Econometrics and Statistics* 3 (2017), pp. 91 –111. DOI: https://doi.org/10.1016/j.ecosta.2017.02.003.
Keywords: Dynamic conditional correlation, Density forecasting, Minimum covariance determinant, Portfolio optimization, Robust statistics.
Abstract: A new approach for multivariate modelling and prediction of asset returns is proposed. It is based on a two-component normal mixture, estimated using a fast new variation of the minimum covariance determinant (MCD) method made suitable for time series.

It outperforms the (shrinkage-augmented) MLE in terms of out-of-sample density forecasts and portfolio performance. In addition to the usual stylized facts of skewness and leptokurtosis, the model also accommodates leverage and contagion effects, but is i.i.d., and thus does not embody, for example, a GARCH-type structure. Owing to analytic tractability of the moments and the expected shortfall, portfolio optimization is straightforward, and, for daily equity returns data, is shown to substantially outperform the equally weighted and classical long-only Markowitz framework, as well as DCC-GARCH (despite not using any kind of GARCH-type filter).

[65] Javier García-Enríquez and Javier Hualde. "Local Whittle estimation of long memory: Standard versus bias-reducing techniques". In: *Econometrics and Statistics* 12 (2019), pp. 66 –77. DOI: https://doi.org/10.1016/j.ecosta.2019.05.004.
Keywords: Memory parameters, Semiparametric estimation, Standard versus bias-reducing techniques, Fractionally integrated processes.
Abstract: Frequency domain semiparametric estimation of memory parameters belongs to the standard toolkit of applied time series researchers. These methods are based on a local approximation of the spectral density, which robustifies the estimation methods against misspecification, but induces a loss with respect to the parametric setting, where the spectral density is known up to a finite number of unknown parameters. In particular, standard semiparametric estimators have convergence rates no better than T2/5, whereas the rate T1/2 is achievable under parametric assumptions. Refinements of the local approximation have been developed by means of bias-reducing techniques, implying that rates arbitrarily close to the parametric one are achievable in the semiparametric setting. Two of these approaches to cover more general settings (including non-stationarity) are extended. A Monte Carlo experiment of finite sample performance is used to assess whether the asymptotic advantages of the bias-reducing methods materialize in better finite sample behavior.

[66] Christian Genest, Ivan Kojadinovic, and Fabrizio Durante. "Introduction to the special topic on copula modeling". In: *Econometrics and Statistics* 12 (2019), pp. 146 –147. DOI: https://doi.org/10.1016/j.ecosta.2019.07.002.

[67] Eric Ghysels and Hang Qian. "Estimating MIDAS regressions via OLS with polynomial parameter profiling". In: *Econometrics and*

Statistics 9 (2019), pp. 1 –16. DOI: https://doi.org/10.1016/j.ecosta.2018.02.001.
Keywords: Mixed frequency data, MIDAS regressions, Profile likelihood.
Abstract: A typical MIDAS regression involves estimating parameters via nonlinear least squares, unless U-MIDAS is applied – which involves OLS – the latter being appealing when the sampling frequency differences are small. It is proposed to use OLS estimation of the MIDAS regression slope and intercept parameters combined with profiling the polynomial weighting scheme parameter(s). The use of Beta polynomials is particularly attractive for such an approach. The new procedure shares many of the desirable features of U-MIDAS, while it is not restricted to small sampling frequency differences.

[68] Nadine Gissibl, Claudia Klüppelberg, and Moritz Otto. "Tail dependence of recursive max-linear models with regularly varying noise variables". In: *Econometrics and Statistics* 6 (2018). STATISTICS OF EXTREMES AND APPLICATIONS, pp. 149 –167. DOI: https://doi.org/10.1016/j.ecosta.2018.02.003.
Keywords: Causal inference, Directed acyclic graph, Extreme value theory, Graphical model, Max-linear model, Max-stable model, Regular variation, Structural equation model, Tail dependence coefficient.
Abstract: Recursive max-linear structural equation models with regularly varying noise variables are considered. Their causal structure is represented by a directed acyclic graph (DAG). The problem of identifying a recursive max-linear model and its associated DAG from its matrix of pairwise tail dependence coefficients is discussed. For example, it is shown that if a causal ordering of the associated DAG is additionally known, then the minimum DAG representing the recursive structural equations can be recovered from the tail dependence matrix. For a relevant subclass of recursive max-linear models, identifiability of the associated minimum DAG from the tail dependence matrix and the initial nodes is shown. Algorithms find the associated minimum DAG for the different situations. Furthermore, given a tail dependence matrix, an algorithm outputs all compatible recursive max-linear models and their associated minimum DAGs.

[69] Vasyl Golosnoy et al. "Statistical inferences for realized portfolio weights". In: *Econometrics and Statistics* 14 (2020), pp. 49 –62. DOI: https://doi.org/10.1016/j.ecosta.2018.08.003.

Keywords: Minimum variance portfolio, Realized covariance matrix, Structural change, Control charts, Tests for portfolio weights.
Abstract: Statistical inferences for weights of the global minimum variance portfolio (GMVP) are of both theoretical and practical relevance for mean-variance portfolio selection. Daily realized GMVP weights depend only on realized covariance matrix computed from intraday high-frequency returns. Both finite sample and asymptotic distributional properties of the realized GMVP weights are deduced. Then, statistical tests for the GMVP proportions are developed in order to provide sequential monitoring with on-line decisions whether a given portfolio composition deviates from the current GMVP significantly. The theoretical results are illustrated both in Monte Carlo simulations and in an empirical application.

[70] Gil González-Rodríguez and Ana Colubi. "On the consistency of bootstrap methods in separable Hilbert spaces". In: *Econometrics and Statistics* 1 (2017), pp. 118 –127. DOI: https://doi.org/10.1016/j.ecosta.2016.11.001.
Keywords: Bootstrap methods, Consistency, Hilbert spaces, Functional data, Independent random elements, Functional sample mean, Functional regression models.
Abstract: Hilbert spaces are frequently used in statistics as a framework to deal with general random elements, specially with functional-valued random variables. The scarcity of common parametric distribution models in this context makes it important to develop nonparametric techniques, and among them, bootstrap has already proved to be specially valuable. The aim is to establish a methodology to derive consistency results for some usual bootstrap methods when working in separable Hilbert spaces. Naive bootstrap, bootstrap with arbitrary sample size, wild bootstrap, and more generally, weighted bootstrap methods, including double bootstrap and bootstrap generated by deterministic weights with the particular case of delete -h jackknife, will be proved to be consistent by applying the proposed methodology. The main results concern the bootstrapped sample mean, however since many usual statistics can be written in terms of means by considering suitable spaces, the applicability is notable. An illustration to show how to employ the approach in the context of a functional regression problem is included.

[71] C. Gourieroux and A. Monfort. "Composite indirect inference with application to corporate risks". In: *Econometrics and Statistics* 7

(2018), pp. 30 –45. DOI: https://doi.org/10.1016/j.ecosta.2017.09.003.
Keywords: Indirect inference, Composite likelihood, Instrumental model, Pseudo maximum likelihood, Corporate risk, Asymptotic single risk factor.
Abstract: It is frequent to deal with parametric models that are difficult to analyze, due to the large number of data and/or parameters, complicated nonlinearities, or unobservable variables. The aim is to explain how to analyze such models by means of a set of simplified models, called instrumental models, and how to combine these instrumental models in an optimal way. In this respect a bridge between the econometric literature on indirect inference and the statistical literature on composite likelihood is provided. The composite indirect inference principle is illustrated by an application to the analysis of corporate risks.

[72] Christian Gourieroux and Joann Jasiak. "Robust analysis of the martingale hypothesis". In: *Econometrics and Statistics* 9 (2019), pp. 17 –41. DOI: https://doi.org/10.1016/j.ecosta.2018.07.001.
Keywords: Martingale hypothesis, Market efficiency, Recurrence, Splitting technique, Noncausal process, Stationary martingale, Nadaraya–Watson estimator, Regenerative block bootstrap.
Abstract: The martingale hypothesis is commonly tested in financial and economic time series. The existing tests of the martingale hypothesis aim at detecting some aspects of nonstationarity, which is considered an inherent feature of a martingale process. However, there exists a variety of martingale processes, some of which are nonstationary like the well-known random walks, and others are stationary with fat-tailed marginal distributions. The stationary martingales display local trends and bubbles, and can feature volatility induced "mean-reversion", like many observed financial and economic time series. This paper introduces nonparametric tests of the martingale hypothesis, which are robust to the type of martingale process that generated the data and are valid for nonstationary as well as stationary martingales. A new regenerative block bootstrap is introduced as an adjustment method for size distortion of the test in finite sample.

[73] Lyudmila Grigoryeva, Juan-Pablo Ortega, and Anatoly Peresetsky. "Volatility forecasting using global stochastic financial trends extracted from non-synchronous data". In: *Econometrics and Statistics*

5 (2018), pp. 67 –82. DOI: https://doi.org/10.1016/j.ecosta.2017.01.003.
Keywords: Multivariate volatility modeling and forecasting, Global stochastic trend, Extended Kalman filter, Dynamic conditional correlations (DCC), Non-synchronous data.
Abstract: A method based on various linear and nonlinear state space models used to extract global stochastic financial trends (GST) out of non-synchronous financial data is introduced. These models are constructed in order to take advantage of the intraday arrival of closing information coming from different international markets so that volatility description and forecasting is improved. A set of three major asynchronous international stock market indices is considered in order to empirically show that this forecasting scheme is capable of significant performance gains when compared to standard parametric models like the dynamic conditional correlation (DCC) family.

[74] Carlo Grillenzoni and Michele Fornaciari. "On-line peak detection in medical time series with adaptive regression methods". In: *Econometrics and Statistics* 10 (2019), pp. 134 –150. DOI: https://doi.org/10.1016/j.ecosta.2018.07.002.
Keywords: Non-stationary processes, Recursive estimators, Stochastic cycles, Turning points, Vital signs.
Abstract: Sequential analysis of medical time series has important implications when data concern vital functions of the human body. Traditional monitoring of vital signs is performed by comparing the level of time series with predetermined target bands. As in industrial control charts, alarm signals start when the series level goes beyond the bands. Many physiological time series, however, are non-stationary with stochastic cycles and are characterized by turning points, i.e. periods where the slope of the series changes sign and determines the beginning of rise and fall phases. Turning points are useful indicators of the effect of drugs and medications and must be timely detected in order to calibrate the drug dosage or perform interventions. Sequential and recursive filters are suitable methods for change and turning points; they are mainly given by double exponential smoothing, time-varying parameter regression and prediction error statistics. Their tuning coefficients can be selected in a data-driven way, by optimizing score functions based on the series' oscillation. Extensive application to real and simulated data shows that adaptive techniques represent effective solutions to on-line mon-

itoring and surveillance in medicine.11Data and Matlab software are provided in the supplementary material.

[75] Lutz F. Gruber and Mike West. "Bayesian online variable selection and scalable multivariate volatility forecasting in simultaneous graphical dynamic linear models". In: *Econometrics and Statistics* 3 (2017), pp. 3 –22. DOI: https://doi.org/10.1016/j.ecosta.2017.03.003.
Abstract: Simultaneous graphical dynamic linear models (SGDLMs) define an ability to scale online Bayesian analysis and multivariate volatility forecasting to higher-dimensional time series. Advances in the methodology of SGDLMs involve a novel, adaptive method of simultaneous predictor selection in forward filtering for online learning and forecasting. This Bayesian methodology for dynamic variable selection and Bayesian computation for scalability are highlighted in a case study evidencing the potential for improved short-term forecasting of large-scale volatility matrices. In financial forecasting and portfolio optimization with a 400-dimensional series of daily stock prices, analysis demonstrates SGDLM forecasts of volatilities and co-volatilities that contribute to quantitative investment strategies to improve portfolio returns. Performance metrics linked to the sequential Bayesian filtering analysis define a leading indicator of increased financial market stresses, comparable to but leading standard financial risk measures. Parallel computation using GPU implementations substantially advance the ability to fit and use these models.

[76] Armelle Guillou. "Special issue on statistics of extremes and applications". In: *Econometrics and Statistics* 6 (2018). STATISTICS OF EXTREMES AND APPLICATIONS, p. 106. DOI: https://doi.org/10.1016/j.ecosta.2018.03.002.

[77] Tomasz Górecki, Lajos Horváth, and Piotr Kokoszka. "Change point detection in heteroscedastic time series". In: *Econometrics and Statistics* 7 (2018), pp. 63 –88. DOI: https://doi.org/10.1016/j.ecosta.2017.07.005.
Keywords: Change point, Functional central limit theorem, Heteroskedastic time series, Karhunen–Loéve expansion.
Abstract: Many time series exhibit changes both in level and in variability. Generally, it is more important to detect a change in the level, and changing or smoothly evolving variability can confound existing tests. A framework for testing for shifts in the level of a series which accommodates the possibility of changing variability is developed. The resulting tests are robust both to heteroskedasticity and serial

dependence. They rely on a new functional central limit theorem for dependent random variables whose variance can change or trend in a substantial way. This new result is of independent interest as it can be applied in many inferential contexts applicable to time series. Its application to change point tests relies on a new approach which utilizes Karhunen–Loéve expansions of the limit Gaussian processes. After presenting the theory in the most commonly encountered setting of the detection of a change point in the mean, it is shown how it can be extended to linear and nonlinear regression. Finite sample performance is examined by means of a simulation study and an application to yields on US treasury bonds.

[78] Md. Abul Hasnat et al. "Evolutionary clustering for categorical data using parametric links among multinomial mixture models". In: *Econometrics and Statistics* 3 (2017), pp. 141 –159. DOI: https://doi.org/10.1016/j.ecosta.2017.03.004.
Keywords: Evolutionary clustering, Multinomial distribution, Mixture model, Model-based clustering, Twitter data.
Abstract: A novel evolutionary clustering method for temporal categorical data based on parametric links among the Multinomial mixture models is proposed. Besides clustering, the main goal is to interpret the evolution of clusters over time. To this aim, first the formulation of a generalized model that establishes parametric links among two Multinomial mixture models is proposed. Afterward, different parametric sub-models are defined in order to model the typical evolution of the clustering structure. Model selection criteria allow to select the best sub-model and thus to guess the clustering evolution. For the experiments, the proposed method is first evaluated with synthetic temporal data. Next, it is applied to analyze the annotated social media data. Results show that the proposed method is better than the state-of-the-art based on the common evaluation metrics. Additionally, it can provide interpretation about the temporal evolution of the clusters.

[79] Harry Haupt, Joachim Schnurbus, and Willi Semmler. "Estimation of grouped, time-varying convergence in economic growth". In: *Econometrics and Statistics* 8 (2018), pp. 141 –158. DOI: https://doi.org/10.1016/j.ecosta.2017.09.001.
Keywords: Growth dynamics, Club convergence, Kernel regression.
Abstract: Classical growth convergence regressions fail to account for various sources of heterogeneity and nonlinearity. Recent contri-

butions advocating nonlinear dynamic factor models remedy these problems by identifying group-specific convergence paths. Similar to statistical clustering methods, those results are sensitive to choices made in the clustering/grouping mechanism. Classical models also do not allow for a time-varying influence of initial endowment on growth. A novel application of a nonparametric regression framework to time-varying, grouped heterogeneity and nonlinearity in growth convergence is proposed. The approach rests upon group-specific transition paths derived from a nonlinear dynamic factor model. Its fully nonparametric nature avoids problems of neglected nonlinearity while alleviating the problem of underspecification of growth convergence regressions. The proposed procedure is backed by an economic rationale for leapfrogging and falling-back of countries due to the time-varying heterogeneity of number, size, and composition of convergence groups. The approach is illustrated by using a current Penn World Table data set. An important aspect of the illustration is empirical evidence for leapfrogging and falling-back of countries, as nonlinearities and heterogeneity in convergence regressions vary over time.

[80] Kazuhiko Hayakawa. "Alternative over-identifying restriction test in the GMM estimation of panel data models". In: *Econometrics and Statistics* 10 (2019), pp. 71 –95. DOI: https://doi.org/10.1016/j.ecosta.2018.06.002.

Keywords: Panel data, GMM, Over-identification test, System of equations.

Abstract: A new over-identifying restriction test in the generalized method of moments (GMM) estimation of panel data models is proposed. In contrast to the conventional over-identifying restriction test, where the sample covariance matrix of the moment conditions is used in the weighting matrix, the proposed test uses a block diagonal weighting matrix constructed from the efficient optimal weighting matrix. It is shown that the proposed test statistic asymptotically follows the weighted sum of the chi-square distribution with one degree of freedom. A detailed local power analysis is provided for dynamic panel data models, and it is demonstrated that the new test has a comparable power to the conventional J test in many cases. The Monte Carlo simulations reveal that the proposed test has a substantially better size property than the conventional test does.

[81] Changli He et al. "The shifting seasonal mean autoregressive model

and seasonality in the Central England monthly temperature series, 1772–2016". In: *Econometrics and Statistics* 12 (2019), pp. 1 –24. DOI: https://doi.org/10.1016/j.ecosta.2019.05.005.
Keywords: Global warming, Nonlinear time series, Changing seasonality, Smooth transition, Testing constancy, Time-varying error variance.
Abstract: A new autoregressive model with seasonal dummy variables in which coefficients of seasonal dummies vary smoothly and deterministically over time is introduced. The error variance of the model is seasonally heteroskedastic and multiplicatively decomposed as in ARCH models. This variance is also allowed to be smoothly and deterministically time-varying. Under regularity conditions, consistency and asymptotic normality of the maximum likelihood estimators of parameters of this model is proved. The purpose of the model is to find out how the average monthly temperatures in the well-known central England temperature series have been varying during the period of more than 240 years. The main result is that warming has occurred but that there are notable differences between months. In particular, no warming is found for February, April, May and June.

[82] Xuming He et al. "Special issue on quantile regression and semiparametric methods". In: *Econometrics and Statistics* 8 (2018), pp. 1 –2. DOI: https://doi.org/10.1016/j.ecosta.2018.09.002.

[83] Alain Hecq and Elisa Voisin. "Forecasting bubbles with mixed causal-noncausal autoregressive models". In: *Econometrics and Statistics* (2020). In press. DOI: https://doi.org/10.1016/j.ecosta.2020.03.007.
Keywords: Noncausal models, Forecasting, Predictive densities, Bubbles, Simulations-based forecasts.
Abstract: Density forecasts of locally explosive processes are investigated using mixed causal-noncausal models, namely time series models with both lag and lead components. In the absence of theoretical expressions for the predictive density for a large range of potential error distributions, two approximation methods are analysed and compared using Monte Carlo simulations. The focus is on the prediction of one-step ahead probabilities of turning points during bubble episodes. A thorough analysis provides some guidance in using these approximation methods during extreme events, with the suggestion to consider both approaches together as they jointly carry

more information. The analysis is illustrated with an application on Nickel prices, focusing on the financial crisis bubble.

[84] John Hinde et al. “Special issue on mixture models”. In: *Econometrics and Statistics* 3 (2017), pp. 89 –90. DOI: https://doi.org/10.1016/j.ecosta.2017.05.002.

[85] Jaroslava Hlouskova and Leopold Sögner. “GMM estimation of affine term structure models”. In: *Econometrics and Statistics* 13 (2020), pp. 2 –15. DOI: https://doi.org/10.1016/j.ecosta.2019.10.001.
Keywords: Affine term-structure models, GMM, Quasi-Bayesian methods.
Abstract: Parameter estimation of affine term structure models by means of the generalized method of moments is investigated. Exact moments of the affine latent process as well as of the yields are obtained by using results derived for p-polynomial processes. Then the generalized method of moments, combined with multi-start random search and Quasi-Bayesian methods, is used to get reliable parameter estimates and to perform inference. After a simulation study, the estimation procedure is applied to empirical interest rate data.

[86] Marius Hofert and Wayne Oldford. “Visualizing dependence in high-dimensional data: An application to S&P 500 constituent data”. In: *Econometrics and Statistics* 8 (2018), pp. 161 –183. DOI: https://doi.org/10.1016/j.ecosta.2017.03.007.
Keywords: Zenpath, Zenplot, Detecting dependence, High dimensions, Graphical tools.
Abstract: The notion of a zenpath and a zenplot is introduced to search and detect dependence in high-dimensional data for model building and statistical inference. By using any measure of dependence between two random variables (such as correlation, Spearman’s rho, Kendall’s tau, tail dependence etc.), a zenpath can construct paths through pairs of variables in different ways, which can then be laid out and displayed by a zenplot. The approach is illustrated by investigating tail dependence and model fit in constituent data of the S&P 500 during the financial crisis of 2007–2008. The corresponding Global Industry Classification Standard (GICS) sector information is also addressed. Zenpaths and zenplots are useful tools for exploring dependence in high-dimensional data, for example, from the realm of finance, insurance and quantitative risk management. All presented algorithms are implemented using the R package zenplots and all

examples and graphics in the paper can be reproduced using the accompanying demo SP500.

[87] Bai Huang, Tae-Hwy Lee, and Aman Ullah. "Combined estimation of semiparametric panel data models". In: *Econometrics and Statistics* (2019). In press. DOI: https://doi.org/10.1016/j.ecosta.2019.05.001.

Keywords: Endogeneity, Panel data, Semiparametric FE estimator, Semiparametric RE estimator, Semiparametric combined estimator, Local asymptotics, Hausman test.

Abstract: The combined estimation for the semiparametric panel data models is proposed. The properties of estimators for the semiparametric panel data models with random effects (RE) and fixed effects (FE) are examined. When the RE estimator suffers from endogeneity due to the individual effects correlated with the regressors, the semiparametric RE and FE estimators may be adaptively combined, with the combining weights depending on the degree of endogeneity. The asymptotic distributions of these three estimators (RE, FE, and combined estimators) for the semiparametric panel data models are derived using a local asymptotic framework. These three estimators are then compared in asymptotic risk. The semiparametric combined estimator has strictly smaller asymptotic risk than the semiparametric fixed effect estimator. The Monte Carlo study shows that the semiparametric combined estimator outperforms semiparametric FE and RE estimators except when the degrees of endogeneity and heterogeneity of the individual effects are very small. Also presented is an empirical application where the effect of public sector capital in the private economy production function is examined using the US state level panel data.

[88] Marcin Jaskowski and Michael McAleer. "Spurious cross-sectional dependence in credit spread changes". In: *Econometrics and Statistics* (2019). In press. DOI: https://doi.org/10.1016/j.ecosta.2019.09.001.

Keywords: Credit spread puzzle, Market segmentation, Latent factors, Spurious cross-sectional dependence.

Abstract: In order to understand the lingering credit risk puzzle and the apparent segmentation of the stock market from credit markets, we need to be able to assess the strength of the cross-sectional dependence in credit spreads. This turns out to be a non-trivial task due to the extreme data sparsity that is typical for any panel of

credit spreads that is extracted from corporate bond transactions. The problem of data sparsity has led to some erroneous conclusions in the literature, including inferences that have been drawn from spurious cross-sectional dependence in credit spread changes. Understanding the pitfalls leads to improved estimation of the latent factor in credit spread changes and its characteristics.

[89] Wenxin Jiang. "On limiting distribution of quasi-posteriors under partial identification". In: *Econometrics and Statistics* 3 (2017), pp. 60 –72. DOI: https://doi.org/10.1016/j.ecosta.2017.03.006.
Keywords: Generalized method of moments, Interval data, Moment inequalities, Partial identification, Quasi-posterior, Total variation.
Abstract: The limiting distribution (in total variation) is established for the quasi posteriors based on moment conditions, which only partially identify the parameters of interest. Some examples are discussed.

[90] George Kapetanios, Simon Price, and Garry Young. "A UK financial conditions index using targeted data reduction: Forecasting and structural identification". In: *Econometrics and Statistics* 7 (2018), pp. 1 –17. DOI: https://doi.org/10.1016/j.ecosta.2017.12.002.
Keywords: Forecasting, Financial conditions index, Targeted data reduction, Multivariate partial least squares, Credit shocks.
Abstract: A financial conditions index (FCI) is designed to summarise the state of financial markets. Two are constructed with UK data. The first is the first principal component of a set of financial indicators. The second comes from a new approach taking information from a large set of macroeconomic variables weighted by the joint covariance with a subset of the financial indicators (a set of spreads), using multivariate partial least squares, again using the first factor. The resulting FCIs are broadly similar. They both have some forecasting power for monthly GDP in a quasi-real-time recursive evaluation from 2011 to 2014 and outperform an FCI produced by Goldman Sachs. A second factor, that may be interpreted as a monetary conditions index, adds further forecast power, while third factors have a mixed effect on performance. The FCIs are used to improve identification of credit supply shocks in an SVAR. The main effects relative to an SVAR excluding an FCI of the (adverse) credit shock IRFs are to make the positive impact on inflation more precise and to reveal an increased positive impact on spreads.

[91] George Kapetanios et al. “State-level wage Phillips curves”. In: *Econometrics and Statistics* (2020). In press. DOI: https://doi.org/10.1016/j.ecosta.2020.03.005.
Keywords: Wage Phillips curves, state-level data, panel estimation, CCE.
Abstract: Based on US state-level data for the period 1982-2016, two reduced-form versions of New Keynesian wage Phillips curves are examined. These are based on either sticky nominal wages or real-wage rigidity. The endogeneity of unemployment is taken into account by instrumentation and the use of common correlated effects (CCE) and mean group (MG) methods. This is the first time that this methodology has been applied in this context. These are important issues, as ignoring them may lead to substantial biases. The results show that while the aggregate data do not provide estimates that are consistent with either of the theoretical models examined, the panel methods do. Moreover, use of an appropriate MG CCE estimator leads to economically significant changes in parameters (primarily a steeper Phillips curve) relative to those from inappropriate but widely used panel methods. In the real-wage rigidity case, this is required to deliver results that have a theoretically admissible interpretation.

[92] Deniz Dilan Karaman Örsal and Antonia Arsova. “Meta-analytic cointegrating rank tests for dependent panels”. In: *Econometrics and Statistics* 2 (2017), pp. 61 –72. DOI: https://doi.org/10.1016/j.ecosta.2016.10.001.
Keywords: Panel cointegration, -value, Common factors, Rank test, Cross-sectional dependence.
Abstract: Two new panel cointegrating rank tests which are robust to cross-sectional dependence are proposed. The dependence in the data generating process is modeled using unobserved common factors. The new tests are based on a meta-analytic approach, in which the p-values of the individual likelihood-ratio (LR) type test statistics computed from defactored data are combined into the panel statistics. A simulation study shows that the tests have reasonable size and power properties in finite samples. The application of the tests is illustrated by investigating the monetary exchange rate model for a panel data of 19 countries.

[93] Frédéric Karamé. “A new particle filtering approach to estimate stochastic volatility models with Markov-switching”. In: *Econometrics and*

Statistics 8 (2018), pp. 204 –230. DOI: https://doi.org/10.1016/j.ecosta.2018.05.004.
Keywords: Stochastic volatility, Bayesian inference, Markov switching, Particle filtering, Smooth resampling, Kim filter, nonlinear Kalman filter.
Abstract: A simple method is proposed to estimate stochastic volatility models with Markov-switching. It relies on a nested structure of filters (a Hamilton filter and several particle filters) to approximate unobserved regimes and state variables, respectively. Smooth resampling is used to keep the computational complexity constant over time and to implement a standard likelihood-based inference on parameters. A bootstrap and an adapted version of the filter are described and their performance are assessed using simulation experiments. The volatility of US and French markets is characterized over the last decade using a three-regime stochastic volatility model extended to include a leverage effect.

[94] Anna Kiriliouk. "Hypothesis testing for tail dependence parameters on the boundary of the parameter space". In: *Econometrics and Statistics* (2019). In press. DOI: https://doi.org/10.1016/j.ecosta.2019.06.001.
Keywords: Brown–Resnick model, Hypothesis testing, Max-linear model, Multivariate extremes, Stable tail dependence function, Tail dependence.
Abstract: Modelling multivariate tail dependence is one of the key challenges in extreme-value theory. Multivariate extremes are usually characterized using parametric models, some of which have simpler submodels at the boundary of their parameter space. Hypothesis tests are proposed for tail dependence parameters that, under the null hypothesis, are on the boundary of the alternative hypothesis. The asymptotic distribution of the weighted least squares estimator is given when the true parameter vector is on the boundary of the parameter space, and two test statistics are proposed. The performance of these test statistics is evaluated for the Brown–Resnick model and the max-linear model. In particular, simulations show that it is possible to recover the optimal number of factors for a max-linear model. Finally, the methods are applied to characterize the dependence structure of two major stock market indices, the DAX and the CAC40.

[95] Jan F. Kiviet. "Microeconometric dynamic panel data methods: Model

specification and selection issues". In: *Econometrics and Statistics* 13 (2020), pp. 16 –45. DOI: https://doi.org/10.1016/j.ecosta.2019.08.003.
Keywords: Classification of regressors, Dynamic impacts, Interaction effects, Generalized method of moments, Labor demand, Panel data model building strategy.
Abstract: A motivated strategy is presented to find step by step an adequate model specification and a matching set of instrumental variables by applying the programming tools provided by the Stata package Xtabond2. The aim is to implement generalized method of moment techniques such that useful and reasonably accurate inferences can be extracted from an observational panel data set on a single microeconometric structural presumably dynamic behavioral relationship. In the suggested specification search three comprehensive heavily interconnected goals are pursued: (i) to include all the relevant appropriately transformed possibly lagged regressors, as well as any interactions between these, if it is required to relax the otherwise very strict homogeneity restrictions on the dynamic impacts of the explanatories in standard linear panel data models; (ii) to correctly classify all regressors as either endogenous, predetermined or exogenous, as well as being either effect-stationary or effect-nonstationary, implying which internal variables could represent valid and relatively strong instruments; (iii) to enhance the accuracy of inference in finite samples by omitting redundant regressors and by profitably reducing the space spanned by the full set of available internal instruments. For the various tests which trigger the decisions to be made in the sequential selection process the relevant considerations are spelled out to interpret the magnitude of p-values. Also the complexities to estimate and interpret the ultimately established dynamic impacts are explained. Finally the developed strategy is applied to a classic data set and is shown to yield new insights.

[96] Jan F. Kiviet and Milan Pleus. "The performance of tests on endogeneity of subsets of explanatory variables scanned by simulation". In: *Econometrics and Statistics* 2 (2017), pp. 1 –21. DOI: https://doi.org/10.1016/j.ecosta.2017.01.001.
Keywords: Bootstrapping, Regressor classification, DWH orthogonality tests, Test implementation, Test performance, Simulation design.

Abstract: Tests for classification as endogenous or predetermined of arbitrary subsets of regressors are formulated as significance tests in auxiliary IV regressions and their relationships with various more classic test procedures are examined and critically compared with statements in the literature. Then simulation experiments are designed by solving the data generating process parameters from salient econometric features, namely: degree of simultaneity and multicollinearity of regressors, and individual and joint strength of external instrumental variables. Next, for various test implementations, a wide class of relevant cases is scanned for flaws in performance regarding type I and II errors. Substantial size distortions occur, but these can be cured remarkably well through bootstrapping, except when instruments are relatively weak. The power of the subset tests is such that they establish an essential addition to the well-known classic full-set DWH tests in a data based classification of individual explanatory variables. This is also illustrated in an empirical example supplemented with hints for practitioners.

[97] Tore Selland Kleppe and Atle Oglend. "Estimating the competitive storage model: A simulated likelihood approach". In: *Econometrics and Statistics* 4 (2017), pp. 39 –56. DOI: https://doi.org/10.1016/j.ecosta.2017.04.001.

Keywords: Commodity prices, Competitive storage model, Particle filter, Rational expectations, Simulated likelihood.

Abstract: A particle filter maximum likelihood estimator for the competitive storage model is developed. The estimator is suitable for inference problems in commodity markets where only reliable price data is available for estimation, and shocks are temporally dependent. The estimator efficiently utilizes the information present in the conditional distribution of prices when shocks are not iid. Compared to Deaton and Laroque's composite quasi-maximum likelihood estimator, simulation experiments and real-data estimation show substantial improvements in both bias and precision. Simulation experiments also show that the precision of the particle filter estimator improves faster than for composite quasi-maximum likelihood with more price data. To demonstrate the estimator and its relevance to actual data, the storage model is fitted to data set of monthly natural gas prices. It is shown that the storage model estimated with the particle filter estimator beats, in terms of log-likelihood, commonly used reduced form

time-series models such as the linear AR(1), AR(1)-GARCH(1,1) and Markov Switching AR(1) models for this data set.

[98] J. Klepsch, C. Klüppelberg, and T. Wei. "Prediction of functional ARMA processes with an application to traffic data". In: *Econometrics and Statistics* 1 (2017), pp. 128 –149. DOI: https://doi.org/10.1016/j.ecosta.2016.10.009.
Keywords: Functional ARMA process, Functional principal component analysis (FPCA), Functional time series analysis (FTSA), Functional prediction, Traffic data analysis.
Abstract: For a functional ARMA(p, q) process an approximating vector model, based on functional PCA, is presented. Sufficient conditions are given for the existence of a stationary solution to both the functional and the vector model equations, and the structure of the approximating vector model is investigated. The stationary vector process is used to predict the functional process, where bounds for the difference between vector and functional best linear predictor are given. Finally, functional ARMA processes are applied for the modeling and prediction of highway traffic data.

[99] Vinnie Ko and Nils Lid Hjort. "Copula information criterion for model selection with two-stage maximum likelihood estimation". In: *Econometrics and Statistics* 12 (2019), pp. 167 –180. DOI: https://doi.org/10.1016/j.ecosta.2019.01.001.
Keywords: Akaike information criterion, Copula, Copula information criterion, Inference functions for margins, Model robust, Two-stage maximum likelihood.
Abstract: In parametric copula setups, where both the margins and copula have parametric forms, two-stage maximum likelihood estimation, often referred to as inference functions for margins, is used as an attractive alternative to the full maximum likelihood estimation strategy. Exploiting the existing model robust inference of two-stage maximum likelihood estimation, a copula information criterion (CIC) for model selection is developed. In a nutshell, CIC aims for the model that minimizes the Kullback–Leibler divergence from the real data generating mechanism. CIC does not assume that the chosen parametric model captures this true model, unlike what is assumed for AIC. In this sense, CIC is analogous to the Takeuchi Information Criterion (TIC), which is defined for the full maximum likelihood. If the additional assumption that a candidate model is correctly specified is made, then CIC for that model simplifies to AIC. Additionally, CIC

can easily be extended to the conditional copula setup where covariates are parametrically linked to the copula model. As a numerical illustration, simulation studies were performed to show that the better model according to CIC also has better prediction performance in general. The result also shows that the bias correction term of CIC penalizes the misspecified model more heavily. This bias correction term has a strong positive relationship with the prediction performance of the model. So, a model with bad prediction performance is being penalized more by CIC. Although this behavior of the bias correction part is an important conceptual advance of CIC, this is not sufficient to make CIC outperform AIC in practice. This is because each misspecified model has the bias correction term and they grow at different speeds, depending on the model. The difference between CIC and AIC becomes minimal as sample size grows because the log-likelihood part outgrows the bias correction part.

[100] Yuta Koike and Yuta Tanoue. "Oracle inequalities for sign constrained generalized linear models". In: *Econometrics and Statistics* 11 (2019), pp. 145 –157. DOI: https://doi.org/10.1016/j.ecosta.2019.02.001.

Keywords: High-dimensions, Oracle inequality, Sign-constraints, Sparsity.

Abstract: High-dimensional data have recently been analyzed because of advancements in data collection technology. Although many methods have been developed for sparse recovery in the past 20 years, most of these methods require the selection of tuning parameters. This requirement means that the results obtained with these methods heavily depend on tuning. Theoretical properties are developed for sign-constrained generalized linear models with convex loss function, which is one of the sparse regression methods that does not require tuning parameters. Recent studies on this subject have shown that, in the case of linear regression, sign-constraints alone could be as efficient as the oracle method if the design matrix enjoys a suitable assumption in addition to a traditional compatibility condition. This type of result is generalized to a model that encompasses logistic and quantile regressions. Some numerical experiments are performed to confirm the theoretical findings.

[101] Piotr Kokoszka et al. "Special issue on functional data analysis". In: *Econometrics and Statistics* 1 (2017), pp. 99 –100. DOI: https://doi.org/10.1016/j.ecosta.2016.11.003.

[102] Erricos Kontoghiorghes, Herman K. Van Dijk, and Ana Colubi. "Econometrics and Statistics". In: *Econometrics and Statistics* 1 (2017), p. 1. DOI: https://doi.org/10.1016/j.ecosta.2016.12.001.

[103] Vikram Krishnamurthy, Elisabeth Leoff, and Jörn Sass. "Filterbased stochastic volatility in continuous-time hidden Markov models". In: *Econometrics and Statistics* 6 (2018). STATISTICS OF EXTREMES AND APPLICATIONS, pp. 1 –21. DOI: https://doi.org/10.1016/j.ecosta.2016.10.007.
Keywords: Markov switching model, Non-constant volatility, Stylized facts, Portfolio optimization, Social learning.
Abstract: Regime-switching models, in particular Hidden Markov Models (HMMs) where the switching is driven by an unobservable Markov chain, are widely-used in financial applications, due to their tractability and good econometric properties. In continuous time, properties of HMMs with constant and of HMMs with switching volatility can be quite different. To have a realistic model with unobservable Markov chain in continuous time and good econometric properties, a regime-switching model where the volatility depends on the filter for the underlying chain is introduced and the filtering equations are stated. Such models are motivated by agent based social learning models in economics. An approximation result for a fixed information filtration is proved and further motivation is provided by considering social learning arguments. The relation to the switching volatility model is analyzed in detail and a convergence result for the discretized model is given. Econometric properties are illustrated by numerical simulations.

[104] Pavel Krupskii and Harry Joe. "Flexible copula models with dynamic dependence and application to financial data". In: *Econometrics and Statistics* (2020). In press. DOI: https://doi.org/10.1016/j.ecosta.2020.01.005.
Keywords: Dynamic dependence, Factor copula, Residual dependence, Tail dependence.
Abstract: A new class of copula models with dynamic dependence is introduced; it can be used when one can assume that there exist a common latent factor that affects all of the observed variables. Conditional on this factor, the distribution of these variables is given by the Gaussian copula with a time-varying correlation matrix, and some observed driving variables can be used to model dynamic correlations. This structure allows one to build flexible and parsimo-

nious models for multivariate data with non-Gaussian dependence that changes over time. The model is computationally tractable in high dimensions and the numerical maximum likelihood estimation is feasible. The proposed class of models is applied to analyze three financial data sets of bond yields, CDS spreads and stock returns. The estimated model is used to construct projected distributions and, for the bond yield and CDS spread datasets, compute the expected maximum number of investments in distress under different scenarios.

[105] Yuta Kurose and Yasuhiro Omori. "Multiple-block dynamic equicorrelations with realized measures, leverage and endogeneity". In: *Econometrics and Statistics* 13 (2020), pp. 46 –68. DOI: https://doi.org/10.1016/j.ecosta.2018.03.003.

Keywords: Asymmetry, Leverage effect, Markov chain Monte Carlo, Multiple-block equicorrelation, Multivariate stochastic volatility, Realized correlation, Realized volatility.

Abstract: The single equicorrelation structure among several daily asset returns is promising and attractive to reduce the number of parameters in multivariate stochastic volatility models. However, such an assumption may not be realistic as the number of assets may increase, for example, in the portfolio optimizations. As a solution to this oversimplification, the multiple-block equicorrelation structure is proposed for high dimensional financial time series, where common correlations within a group of asset returns are assumed, but different correlations for different groups are allowed. The realized volatilities and realized correlations are also jointly modelled to obtain stable and accurate estimates of parameters, latent variables and leverage effects. Using a state space representation, an efficient estimation method of Markov chain Monte Carlo simulation is described. Empirical studies using U.S. daily stock returns data show that the proposed model outperforms other competing models in portfolio performances.

[106] Ananya Lahiri and Rituparna Sen. "Fractional Brownian markets with time-varying volatility and high-frequency data". In: *Econometrics and Statistics* (2018). In press. DOI: https://doi.org/10.1016/j.ecosta.2018.10.004.

Keywords: Asymptotic normality, Fractional Black–Scholes model, Malliavin calculus, Option price, Volatility, Wick financing, Wick Ito Skorohod integration, Wiener chaos.

Abstract: Diffusion processes driven by fractional Brownian motion (fBm) have often been considered in modeling stock price dynamics in order to capture the long range dependence of stock prices observed in real markets. Option prices for such models under constant drift and volatility are available. Option prices are obtained under time varying volatility. The expression of option price depends on the volatility and the Hurst parameter of the model, in a complicated manner. A central limit theorem is derived for the quadratic variation as an estimator for volatility for both the cases, constant as well as time varying volatility. The estimator of volatility is useful for finding estimators of option prices and their asymptotic distributions.

[107] Francesco Lamperti. "An information theoretic criterion for empirical validation of simulation models". In: *Econometrics and Statistics* 5 (2018), pp. 83 –106. DOI: https://doi.org/10.1016/j.ecosta.2017.01.006.

Keywords: Simulations, Empirical validation, Model selection, Time series, Agent Based Models.

Abstract: Simulated models suffer intrinsically from validation and comparison problems. The choice of a suitable indicator quantifying the distance between the model and the data is pivotal to model selection. An information theoretic criterion, called GSL-div, is introduced to measure how closely models' synthetic output replicates the properties of observable time series without the need to resort to the likelihood function or to impose stationarity requirements. The indicator is sufficiently general to be applied to any model able to simulate or predict time series data, from simple univariate models to more complex objects including Agent-Based Models. When a set of models is given, a simple function of the L-divergence is used to select the candidate producing distributions of patterns that are closest to those observed in the data. The proposed approach is illustrated through three examples of increasing complexity where the GSL-div is used to discriminate among a variety of competing models. Results are compared to those obtained employing alternative measures of model's fit. The GSL-div is found to perform, in the vast majority of cases, better than the alternatives.

[108] Markus Leippold and Hanlin Yang. "Particle filtering, learning, and smoothing for mixed-frequency state-space models". In: *Econometrics and Statistics* 12 (2019), pp. 25 –41. DOI: https://doi.org/10.1016/j.ecosta.2019.07.001.

Keywords: Mixed-frequency, State-space models, Particle filtering, Backward smoothing, Stochastic volatility, Return predictability.
Abstract: A particle filter approach for general mixed-frequency state-space models is considered. It employs a backward smoother to filter high-frequency state variables from low-frequency observations. Moreover, it preserves the sequential nature of particle filters, allows for non-Gaussian shocks and nonlinear state-measurement relation, and alleviates the concern over sample degeneracy. Simulation studies show that it outperforms the commonly used state-augmented approach for mixed-frequency data for filtering and smoothing. In an empirical exercise, predictive mixed-frequency regressions are employed for Treasury bond and US dollar index returns with quarterly predictors and monthly stochastic volatility. Stochastic volatility improves model inference and forecasting power in a mixed-frequency setup but not for quarterly aggregate models.

[109] Christian Leschinski and Philipp Sibbertsen. "Model order selection in periodic long memory models". In: *Econometrics and Statistics* 9 (2019), pp. 78 –94. DOI: https://doi.org/10.1016/j.ecosta.2017.11.002.
Keywords: Seasonal long memory, k-factor Gegenbauer processes, Model selection, Electricity loads.
Abstract: An automatic model order selection procedure for k-factor Gegenbauer processes is proposed. The procedure is based on sequential tests of the maximum of the periodogram and semiparametric estimators of the model parameters. As a byproduct, a generalized version of Walker's large sample g-test is introduced that allows to test for persistent periodicity in stationary short memory processes. Simulation studies show that the model order selection procedure performs well in identifying the correct order under various circumstances. An application to Californian electricity load data illustrates its value in empirical analyses and allows new insights into the periodicity of this process that has been the subject of several studies.

[110] Dan Li, Adam Clements, and Christopher Drovandi. "Efficient Bayesian estimation for GARCH-type models via Sequential Monte Carlo". In: *Econometrics and Statistics* (2020). In press. DOI: https://doi.org/10.1016/j.ecosta.2020.02.002.
Keywords: Markov chain Monte Carlo, Time series analysis, Volatility distribution, Cross-validation, Data annealing.

Abstract: The advantages of sequential Monte Carlo (SMC) are exploited to develop parameter estimation and model selection methods for GARCH (Generalized AutoRegressive Conditional Heteroskedasticity) style models. It provides an alternative method for quantifying estimation uncertainty relative to classical inference. Even with long time series, it is demonstrated that the posterior distribution of model parameters are non-normal, highlighting the need for a Bayesian approach and an efficient posterior sampling method. Efficient approaches for both constructing the sequence of distributions in SMC, and leave-one-out cross-validation, for long time series data are also proposed. Finally, an unbiased estimator of the likelihood is developed for the Bad Environment-Good Environment model, a complex GARCH-type model, which permits exact Bayesian inference not previously available in the literature.

[111] Shu Li, Jan Ernest, and Peter Bühlmann. "Nonparametric causal inference from observational time series through marginal integration". In: *Econometrics and Statistics* 2 (2017), pp. 81 –105. DOI: https://doi.org/10.1016/j.ecosta.2016.11.002.

Keywords: Application to economics, Backdoor adjustment, Nonparametric kernel regression, Structural equation models, Total causal effects, Instantaneous effects.

Abstract: Causal inference from observational data is an ambitious but highly relevant task, with diverse applications ranging from natural to social sciences. Within the scope of nonparametric time series, causal inference defined through interventions is largely unexplored, although time order simplifies the problem substantially. A marginal integration scheme is considered for inferring causal effects from observational time series data, MINT-T (marginal integration in time series), which is an adaptation for time series of a previously proposed method for the case of independent data. This approach for stationary stochastic processes is fully nonparametric and, assuming no instantaneous effects consistently recovers the total causal effect of a single intervention with optimal one-dimensional nonparametric convergence rate n-2/5 assuming regularity conditions and twice differentiability of a certain corresponding regression function. Therefore, MINT-T remains largely unaffected by the curse of dimensionality as long as smoothness conditions hold in higher dimensions and it is feasible for a large class of stationary time series, including nonlinear and multivariate processes. For the case with instantaneous

effects, we provide a procedure which guards against false positive causal statements.

[112] Zhaoyuan Li and Jianfeng Yao. "Testing for heteroscedasticity in high-dimensional regressions". In: *Econometrics and Statistics* 9 (2019), pp. 122 –139. DOI: https://doi.org/10.1016/j.ecosta.2018.01.001.

Keywords: Breusch and Pagan test, White's test, Heteroscedasticity, High-dimensional regression, Hypothesis testing, Haar matrix.

Abstract: Testing heteroscedasticity of the errors is a major challenge in high-dimensional regressions where the number of covariates is large compared to the sample size. Traditional procedures such as the White and the Breusch–Pagan tests typically suffer from low sizes and powers. Two new test procedures are proposed based on standard OLS residuals. Using the theory of random Haar orthogonal matrices, the asymptotic normality of both test statistics is obtained under the null when the degrees of freedom tend to infinity. This encompasses both the classical low-dimensional setting where the number of variables is fixed while the sample size tends to infinity, and the proportional high-dimensional setting where these dimensions grow to infinity proportionally. This is the first procedures in the literature for testing heteroscedasticity which are valid for medium and high-dimensional regressions. Notice however that as the procedures are based on the OLS residuals, the number of variables must be smaller than the sample size, although both can grow to infinity. The superiority of our proposed tests over the existing methods are demonstrated by extensive simulations and by several real data analyses as well.

[113] Dominik Liebl and Fabian Walders. "Parameter regimes in partial functional panel regression". In: *Econometrics and Statistics* 11 (2019), pp. 105 –115. DOI: https://doi.org/10.1016/j.ecosta.2018.05.003.

Keywords: Functional data analysis, Mixed data, Partial functional linear regression model, Classification, Idiosyncratic volatility puzzle.

Abstract: A new partial functional linear regression model for panel data with time varying parameters is introduced. The parameter vector of the multivariate model component is allowed to be completely time varying while the function-valued parameter of the functional model component is assumed to change over K unknown parameter regimes. Consistency is derived for the suggested estimators and for

the classification procedure used to detect the K unknown parameter regimes. Additionally, the convergence rates of the estimators are derived under a double asymptotic differentiating between asymptotic scenarios depending on the relative order of the panel dimensions n and T. The statistical model is motivated by a real data application considering the so-called "idiosyncratic volatility puzzle" using high frequency data from the S&P500.

[114] Gareth Liu-Evans and Garry D.A. Phillips. "On the use of higher order bias approximations for 2SLS and k-class estimators with non-normal disturbances and many instruments". In: *Econometrics and Statistics* 6 (2018). STATISTICS OF EXTREMES AND APPLICATIONS, pp. 90 –105. DOI: https://doi.org/10.1016/j.ecosta.2017.06.002.

Keywords: Bias approximation, 2SLS, k-class, Simultaneous equation model, Many instruments, Weak instruments.

Abstract: The first and second moment approximations for the k-class of estimators were originally obtained in a general static simultaneous equation model under the assumption that the structural disturbances were i.i.d. and normally distributed. Later, higher-order bias approximations were obtained and were shown to be important especially in highly over identified cases. It is shown that the higher order bias approximation continues to be valid under symmetric, but not necessarily normal, disturbances with an arbitrary degree of kurtosis, but not when the disturbances are asymmetric. A modified higher-order approximation for the bias is then obtained which includes the case of asymmetric disturbances. The effect of asymmetry in the disturbances is explored in the context of a two equation model where it is shown that the bias of 2SLS may be substantially changed when the skewness factor increases. The use of the bias approximation is illustrated using empirical applications relating to the return to schooling, where a model with many instruments is employed, and to higher education wage premia.

[115] Helmut Lütkepohl and Aleksei Netšunajev. "Structural vector autoregressions with heteroskedasticity: A review of different volatility models". In: *Econometrics and Statistics* 1 (2017), pp. 2 –18. DOI: https://doi.org/10.1016/j.ecosta.2016.05.001.

Keywords: Structural vector autoregression, Identification via heteroskedasticity, Conditional heteroskedasticity, Smooth transition, Markov switching, GARCH.

Abstract: Changes in residual volatility are often used for identifying structural shocks in vector autoregressive (VAR) analysis. A number of different models for heteroskedasticity or conditional heteroskedasticity are proposed and used in applications in this context. The different volatility models are reviewed and their advantages and drawbacks are indicated. An application investigating the interaction between U.S. monetary policy and the stock market illustrates the related issues.

[116] Helmut Lütkepohl, Anna Staszewska-Bystrova, and Peter Winker. "Constructing joint confidence bands for impulse response functions of VAR models – A review". In: *Econometrics and Statistics* 13 (2020), pp. 69 –83. DOI: https://doi.org/10.1016/j.ecosta.2018.10.002.

Keywords: Impulse responses, Vector autoregressive model, Joint confidence bands.

Abstract: Methods for constructing joint confidence bands for impulse response functions which are commonly used in vector autoregressive analysis are reviewed. While considering separate intervals for each horizon individually still seems to be the most common approach, a substantial number of methods have been proposed for making joint inferences about the complete impulse response paths up to a given horizon. A structured presentation of these methods is provided. Furthermore, existing evidence on the small-sample performance of the methods is gathered. The collected information can help practitioners to decide on a suitable confidence band for a structural VAR analysis.

[117] Matúš Maciak. "Quantile LASSO with changepoints in panel data models applied to option pricing". In: *Econometrics and Statistics* (2020). In press. DOI: https://doi.org/10.1016/j.ecosta.2019.12.005.

Keywords: panel data, changepoints, sparsity, quantile LASSO, options.

Abstract: Panel data are modern statistical tools which are commonly used in all kinds of econometric problems under various regularity assumptions. The panel data models with changepoints are introduced together with the atomic pursuit idea and they are applied to estimate the underlying option price function. Robust estimates and complex insight into the data are both achieved by adopting the quantile LASSO approach. The final model is produced in a fully

data-driven manner in just one single modeling step. In addition, the arbitrage-free scenarios are obtained by introducing a set of well defined linear constraints. The final estimate is, under some reasonable assumptions, consistent with respect to the model estimation and the changepoint detection performance. The finite sample properties are investigated in a simulation study and proposed methodology is applied for the Apple call option pricing problem.

[118] John M. Maheu et al. "Special issue on risk management". In: *Econometrics and Statistics* 8 (2018), pp. 159 –160. DOI: https://doi.org/10.1016/j.ecosta.2018.09.001.

[119] Xiuping Mao et al. "Asymmetric stochastic volatility models: Properties and particle filter-based simulated maximum likelihood estimation". In: *Econometrics and Statistics* 13 (2020), pp. 84 –105. DOI: https://doi.org/10.1016/j.ecosta.2019.08.002.
Keywords: Particle filtering, Leverage effect, SV models, Value-at-risk.
Abstract: The statistical properties of a general family of asymmetric stochastic volatility (A-SV) models which capture the leverage effect in financial returns are derived providing analytical expressions of moments and autocorrelations of power-transformed absolute returns. The parameters of the A-SV model are estimated by a particle filter-based simulated maximum likelihood estimator and Monte Carlo simulations are carried out to validate it. It is shown empirically that standard SV models may significantly underestimate the value-at-risk of weekly S&P 500 returns at dates following negative returns and overestimate it after positive returns. By contrast, the general specification proposed provide reliable forecasts at all dates. Furthermore, based on daily S&P 500 returns, it is shown that the most adequate specification of the asymmetry can change over time.

[120] Martyna Marczak, Tommaso Proietti, and Stefano Grassi. "A data-cleaning augmented Kalman filter for robust estimation of state space models". In: *Econometrics and Statistics* 5 (2018), pp. 107 –123. DOI: https://doi.org/10.1016/j.ecosta.2017.02.002.
Keywords: Robust filtering, Augmented Kalman filter, Structural time series model, Additive outlier, Innovation outlier.
Abstract: A robust augmented Kalman filter (AKF) is presented for the general state space model featuring non-stationary and regression effects. The robust filter shrinks the observations towards their one-step-ahead prediction based on the past, by bounding the effect of

the information carried by a new observation according to an influence function. When maximum likelihood estimation is carried out on the replacement data, an M-type estimator is obtained. The performance of the robust AKF is investigated in two applications using as a modeling framework the basic structural time series model—a popular unobserved components model in the analysis of seasonal time series. First, a Monte Carlo experiment is conducted in order to evaluate the comparative accuracy of the proposed method for estimating the variance parameters. Second, the method is applied in a forecasting context to a large set of European trade statistics series.

[121] J.S. Marron. "Big Data in context and robustness against heterogeneity". In: *Econometrics and Statistics* 2 (2017), pp. 73 –80. DOI: https://doi.org/10.1016/j.ecosta.2016.06.001.
Keywords: Big data, Robustness against heterogeneity.
Abstract: The phrase Big Data has generated substantial current discussion within and outside of the field of statistics. Some personal observations about this phenomenon are discussed. One contribution is to put this set of ideas into a larger historical context. Another is to point out the related important concept of robustness against data heterogeneity, and some earlier methods which had that property, and also to discuss a number of interesting open problems motivated by this concept.

[122] M. Matilainen et al. "Supervised dimension reduction for multivariate time series". In: *Econometrics and Statistics* 4 (2017), pp. 57 –69. DOI: https://doi.org/10.1016/j.ecosta.2017.04.002.
Abstract: A regression model where the response as well as the explaining variables are time series is considered. A general model which allows supervised dimension reduction in this context is suggested without considering the form of dependence. The method for this purpose combines ideas from sliced inverse regression (SIR) and blind source separation methods to obtain linear combinations of the explaining time series which are ordered according to their relevance with respect to the response. The method gives also an indication of which lags of the linear combinations are of importance. The method is demonstrated using simulations and a real data example.

[123] Hidetoshi Matsui. "Quadratic regression for functional response models". In: *Econometrics and Statistics* 13 (2020), pp. 125 –136. DOI: https://doi.org/10.1016/j.ecosta.2018.12.003.

Keywords: Functional data analysis, Gaussian process, Interaction, Model selection.
Abstract: A problem of constructing a regression model with a functional predictor and a functional response is considered. A functional quadratic model is an extension of a functional linear model and includes the quadratic term that takes the interaction between two different time points of the functional data into consideration. Predictor and the coefficient functions in the model are supposed to be expressed by basis expansions, and then parameters included in the model are estimated by the penalized likelihood method assuming that the error function follows a Gaussian process. Monte Carlo simulations are conducted to illustrate the efficacy of the proposed method. Finally, the proposed method is applied to the analysis of meteorological data and the results are explored.

[124] Simone Maxand. "Identification of independent structural shocks in the presence of multiple Gaussian components". In: *Econometrics and Statistics* (2018). In press. DOI: https://doi.org/10.1016/j.ecosta.2018.10.005.
Keywords: SVAR, Identification, Non-Gaussian, Monetary policy, Asset prices.
Abstract: Several recently developed identification techniques for structural VAR models are based on the assumption of non-Gaussianity. So-called independence based identification provides unique structural shocks (up to scaling and ordering) under the assumption of at most one Gaussian component. While non-Gaussianity of certain interesting shocks appears rather natural, not all macroeconomic shocks in the system might show this clear difference from Gaussianity. Identifiability can be generalized by noting that even in the presence of multiple Gaussian shocks the non-Gaussian ones are still unique. Consequently, independence based identification allows to uniquely determine the (non-Gaussian) shocks of interest irrespective of the distribution of the remaining system. Furthermore, studying settings close to normality or with multiple Gaussian components highlights the performance of normality diagnostics and their applicability to decide on the identifiability of the structural shock components. In an illustrative five dimensional model the identified monetary policy and stock price shock confirm the results of previous studies on the monetary policy asset price nexus.

[125] Tucker S. McElroy and Marc Wildi. "The Multivariate Linear Pre-

diction Problem: Model-Based and Direct Filtering Solutions". In: *Econometrics and Statistics* 14 (2020), pp. 112 –130. DOI: https://doi.org/10.1016/j.ecosta.2019.12.004.
Keywords: Frequency Domain, Seasonality, Time Series, Trends.
Abstract: Numerous contexts in macroeconomics, finance, and quality control require real-time estimation of trends, turning points, and anomalies. The real-time signal extraction problem is formulated as a multivariate linear prediction problem, the optimal solution is presented in terms of a known model, and multivariate direct filter analysis is proposed to address the more typical situation where the process' model is unknown. It is shown how general constraints – such as level and time shift constraints – can be imposed on a concurrent filter in order to guarantee that real-time estimates have requisite properties. The methodology is applied to petroleum and construction data.

[126] Loukia Meligkotsidou, Elias Tzavalis, and Ioannis Vrontos. "On Bayesian analysis and unit root testing for autoregressive models in the presence of multiple structural breaks". In: *Econometrics and Statistics* 4 (2017), pp. 70 –90. DOI: https://doi.org/10.1016/j.ecosta.2017.04.004.
Keywords: Autoregressive models, Bayesian inference, Forward–backward algorithm, Model comparison, Non-linear representation, Structural breaks, Unit root testing.
Abstract: A Bayesian approach is suggested for inferring stationary autoregressive models allowing for possible structural changes (known as breaks) in both the mean and the error variance of economic series occurring at unknown times. Efficient Bayesian inference for the unknown number and positions of the structural breaks is performed by using filtering recursions similar to those of the forward–backward algorithm. A Bayesian approach to unit root testing is also proposed, based on the comparison of stationary autoregressive models with multiple breaks to their counterpart unit root models. In the Bayesian setting, the unknown initial conditions are treated as random variables, which is particularly appropriate in unit root testing. Simulation experiments are conducted with the aim to assess the performance of the suggested inferential procedure, as well as to investigate if the Bayesian model comparison approach can distinguish unit root models from stationary autoregressive models with multiple structural breaks in the parameters. The proposed method

is applied to key economic series with the aim to investigate whether they are subject to shifts in the mean and/or the error variance. The latter has recently received an economic policy interest as improved monetary policies have also as a target to reduce the volatility of economic series.

[127] J. Isaac Miller. "Simple robust tests for the specification of high-frequency predictors of a low-frequency series". In: *Econometrics and Statistics* 5 (2018), pp. 45 –66. DOI: https://doi.org/10.1016/j.ecosta.2016.09.001.

Keywords: Temporal aggregation, Mixed-frequency model, MIDAS, Variable addition test, Forecasting model comparison, Retail gasoline prices.

Abstract: Two variable addition test statistics aimed at the specification of a high-frequency predictor of a series observed at a lower frequency are proposed. Under the null, the high-frequency predictor is aggregated to the low frequency versus mixed-frequency alternatives. The first test statistic is similar to those in the extant literature, but its robustness to conditionally biased forecast error and cointegrated and deterministically trending covariates is shown. It is feasible and consistent even if estimation is not feasible under the alternative. However, its size is not robust to nuisance parameters when the high-frequency predictor is stochastically trending, and size distortion may be severe. The second test statistic is a simple modification of the first that sacrifices power in order to correct this distortion. An application to forecasting and nowcasting monthly state-level retail gasoline prices illustrates how the test statistics may be utilized when the presence of nuisance parameters and orders of integration are unknown.

[128] Claudio Morana. "Regularized semiparametric estimation of high dimensional dynamic conditional covariance matrices". In: *Econometrics and Statistics* 12 (2019), pp. 42 –65. DOI: https://doi.org/10.1016/j.ecosta.2019.04.001.

Keywords: Conditional covariance, Dynamic conditional correlation model, Semiparametric dynamic conditional correlation model, Multivariate GARCH.

Abstract: A three-step estimation strategy for dynamic conditional correlation (DCC) models is proposed. In the first step, conditional variances for individual and aggregate series are estimated by means of QML equation by equation. In the second step, conditional covari-

ances are estimated by means of the polarization identity and conditional correlations are estimated by their usual normalization. In the third step, the two-step conditional covariance and correlation matrices are regularized by means of a new non-linear shrinkage procedure and optimally smoothed. Due to its scant computational burden, the proposed regularized semiparametric DCC model (RSP-DCC) allows to estimate high dimensional conditional covariance and correlation matrices. An application to global minimum variance portfolio is also provided, confirming that RSP-DCC is a simple and viable alternative to existing DCC models.

[129] Seyed Nourollah Mousavi and Helle Sørensen. "Multinomial functional regression with wavelets and LASSO penalization". In: *Econometrics and Statistics* 1 (2017), pp. 150 –166. DOI: https://doi.org/10.1016/j.ecosta.2016.09.005.
Keywords: Discrete wavelet transform, Functional predictor, Supervised classification, Lameness data for horses, Phoneme data.
Abstract: A classification problem with a functional predictor is studied, and it is suggested to use a multinomial functional regression (MFR) model for the analysis. The discrete wavelet transform and LASSO penalization are combined for estimation, and the fitted model is used for classification of new curves with unknown class membership. The MFR approach is applied to two datasets, one regarding lameness detection for horses and another regarding speech recognition. In the applications, as well as in a simulation study, the performance of the MFR approach is compared to that of other methods for supervised classification of functional data, and MFR performs as well or better than the other methods.

[130] Christophe Muller. "Heterogeneity and nonconstant effect in two-stage quantile regression". In: *Econometrics and Statistics* 8 (2018), pp. 3 –12. DOI: https://doi.org/10.1016/j.ecosta.2017.07.004.
Keywords: Two-stage estimation, Quantile regression, Fitted-value setting, Nonconstant effect, Partial identification.
Abstract: Heterogeneity in how some independent variables affect a dependent variable is pervasive in many phenomena. In this respect, this paper addresses the question of constant versus nonconstant effect through quantile regression modelling. For linear quantile regression under endogeneity, it is often believed that the fitted-value setting (i.e., replacing endogenous regressors with their exogenous fitted-values) implies constant effect (that is: the coefficients of the

covariates do not depend on the considered quantile, except for the intercept). Here, it is shown that, under a weakened instrumental variable restriction, the fitted-value setting can allow for nonconstant effect, even though only the constant-effect coefficients of the model can be identified. An application to food demand estimation in 2012 Egypt shows the practical potential of this approach.

[131] Nelson Muriel and Graciela González-Farías. "Testing the null of difference stationarity against the alternative of a stochastic unit root: A new test based on multivariate STUR". In: *Econometrics and Statistics* 7 (2018), pp. 46 –62. DOI: https://doi.org/10.1016/j.ecosta.2017.10.003.

Keywords: Nonstationary time series, Random coefficient autoregression, Score test, Time varying coefficients.

Abstract: A multivariate stochastic unit root process is used to test a simple versus a stochastic unit root. The score statistic and its asymptotic distribution under the null are given, and the test is seen to have a very acceptable power function. Simulations are performed to assess the robustness of the procedure in two common circumstances: preselecting the autoregressive order for the series using Akaike's Information Criterion, and allowing for an MA component. An empirical application to macroeconomic and financial series is given to illustrate the test and to compare it to the main alternatives in the literature.

[132] Paula M. Murray, Ryan P. Browne, and Paul D. McNicholas. "A mixture of SDB skew-t factor analyzers". In: *Econometrics and Statistics* 3 (2017), pp. 160 –168. DOI: https://doi.org/10.1016/j.ecosta.2017.05.001.

Keywords: Clustering, Factor analyzers, Mixture models, Skew-.

Abstract: Mixtures of skew-t distributions offer a flexible choice for model-based clustering. A mixture model of this sort can be implemented using a variety of formulations of the skew-t distribution. A mixture of skew-t factor analyzers model for clustering of high-dimensional data using a flexible formulation of the skew-t distribution is developed. Methodological details of the proposed approach, which represents an extension of the mixture of factor analyzers model to a flexible skew-t distribution, are outlined and details of parameter estimation are provided. Clustering results are illustrated and compared to an alternative formulation of the mixture of skew-

t factor analyzers model as well as the mixture of factor analyzers model.

[133] Willi Mutschler. "Higher-order statistics for DSGE models". In: *Econometrics and Statistics* 6 (2018). STATISTICS OF EXTREMES AND APPLICATIONS, pp. 44 –56. DOI: https://doi.org/10.1016/j.ecosta.2016.10.005.
Keywords: Higher-order moments, Cumulants, Polyspectra, Nonlinear DSGE, Pruning, GMM.
Abstract: Closed-form expressions for unconditional moments, cumulants and polyspectra of order higher than two are derived for non-Gaussian or nonlinear (pruned) solutions to DSGE models. Apart from the existence of moments and white noise property no distributional assumptions are needed. The accuracy and utility of the formulas for computing skewness and kurtosis are demonstrated by three prominent models: the baseline medium-sized New Keynesian model used for empirical analysis (first-order approximation), a small-scale business cycle model (second-order approximation) and the neoclassical growth model (third-order approximation). Both the Gaussian as well as Student's t-distribution are considered as the underlying stochastic processes. Lastly, the efficiency gain of including higher-order statistics is demonstrated by the estimation of a RBC model within a Generalized Method of Moments framework.

[134] Milda Norkutė and Joakim Westerlund. "The factor analytical method for interactive effects dynamic panel models with moving average errors". In: *Econometrics and Statistics* 11 (2019), pp. 83 –104. DOI: https://doi.org/10.1016/j.ecosta.2018.09.003.
Keywords: Interactive fixed effects, Dynamic panel data models, Moving average errors, Factor analytical method.
Abstract: The estimation of dynamic panel data models with interactive effects and moving average errors is considered. This is accomplished by making an extension to the factor analytical (FA) estimator which was originally designed for dynamic panels with fixed effects only and serially uncorrelated errors. The results show that the additional allowances have no effect on the asymptotic properties of the FA estimator. In particular, the asymptotic distribution of the estimator is free of the otherwise so common bias problem, a result that is verified in small samples using Monte Carlo simulation.

[135] Fabian Otto-Sobotka et al. "Adaptive semiparametric M-quantile re-

gression". In: *Econometrics and Statistics* 11 (2019), pp. 116 –129. DOI: https://doi.org/10.1016/j.ecosta.2019.03.001.
Keywords: Iteratively weighted least squares, P-splines, Semiparametric regression, Heteroscedasticity, Two-stage estimation, Expectiles.
Abstract: Parametric and semiparametric regression beyond the mean have become important tools for multivariate data analysis in this world of heteroscedasticity. Among several alternatives, quantile regression is a very popular choice if regression on more than a location measure is desired. This is also due to the inherent robustness of a quantile estimate. However, when moving towards the tails of a distribution, the handling of extreme observations becomes crucial for empirical estimates. M-quantiles handle outliers within the regression analysis by imposing a strong robustness to the loss function. However, this loss function is typically not designed to handle heteroscedasticity. An adaptive extension to the degree of robustness within the loss function is proposed along with the implementation of semiparametric predictors in an M-quantile regression model. A practical method to compute confidence intervals is also presented. The methods are supported by extensive simulations and an analysis of childhood malnutrition in Tanzania.

[136] Davy Paindaveine, Rondrotiana Joséa Rasoafaraniaina, and Thomas Verdebout. "Preliminary test estimation for multi-sample principal components". In: *Econometrics and Statistics* 2 (2017), pp. 106 – 116. DOI: https://doi.org/10.1016/j.ecosta.2017.01.004.
Keywords: Preliminary test estimation, Common principal components.
Abstract: Point estimation is considered in a multi-sample principal components setup, in a situation where it is suspected that the hypothesis of common principal components (CPC) holds. Preliminary test estimators of the various principal eigenvectors are proposed. Their asymptotic distributions are derived (i) under the CPC hypothesis, (ii) under sequences of hypotheses that are contiguous to the CPC hypothesis, and (iii) away from the CPC hypothesis. A Monte-Carlo study shows that the proposed estimators perform well, particularly so in the Gaussian case.

[137] Efstathios Panayi et al. "Designating market maker behaviour in limit order book markets". In: *Econometrics and Statistics* 5 (2018), pp. 20 –44. DOI: https://doi.org/10.1016/j.ecosta.2016.10.008.

Keywords: Limit order book, Liquidity, Resilience, GLM, GAMLSS.
Abstract: Financial exchanges provide incentives for limit order book (LOB) liquidity provision to certain market participants, termed designated market makers or designated sponsors. While quoting requirements typically enforce the activity of these participants for a certain portion of the day, an argument that liquidity demand throughout the trading day is far from uniformly distributed is made, and thus this liquidity provision may not be calibrated to the demand. Furthermore, it is propose that quoting obligations also include requirements about the speed of liquidity replenishment, and then a recommendation that use of the Threshold Exceedance Duration (TED) for this purpose be considered. To support this argument a comprehensive regression modelling approach using GLM and GAMLSS models to relate the TED to the state of the LOB and identify the regression structures that are best suited to modelling the TED is presented. Such an approach can be used by exchanges to set target levels of liquidity replenishment for designated market makers.

[138] Marc S. Paolella. "Asymmetric stable Paretian distribution testing". In: *Econometrics and Statistics* 1 (2017), pp. 19 –39. DOI: https://doi.org/10.1016/j.ecosta.2016.05.002.
Keywords: Hill-type estimators, Likelihood ratio test, Tail index.
Abstract: Two new tests for the symmetric stable Paretian distribution with tail index $1 < \alpha < 2$ are proposed. The test statistics and their associated approximate p-values are instantly computed and do not require use of the stable density or distribution or maximum likelihood estimation. They exhibit high power against a variety of alternatives, and much higher power than the existing test based on the empirical characteristic function. The two tests are combined to yield a test that has substantially higher power. A fourth test based on likelihood ratio is also studied. Extensions are proposed to address the asymmetric case and are shown to have reasonable actual size properties and high power against several viable alternatives.

[139] M. Hashem Pesaran and Ron P. Smith. "A Bayesian analysis of linear regression models with highly collinear regressors". In: *Econometrics and Statistics* 11 (2019), pp. 1 –21. DOI: https://doi.org/10.1016/j.ecosta.2018.10.001.
Keywords: Bayesian identification, Multicollinear regressions, Weakly identified regression coefficients, Highly collinear regressors.

Abstract: Exact collinearity between regressors makes their individual coefficients not identified. But, given an informative prior, their Bayesian posterior means are well defined. Just as exact collinearity causes non-identification of the parameters, high collinearity can be viewed as weak identification of the parameters, which is represented, in line with the weak instrument literature, by the correlation matrix being of full rank for a finite sample size T, but converging to a rank deficient matrix as T goes to infinity. The asymptotic behaviour of the posterior mean and precision of the parameters of a linear regression model are examined in the cases of exactly and highly collinear regressors. In both cases the posterior mean remains sensitive to the choice of prior means even if the sample size is sufficiently large, and that the precision rises at a slower rate than the sample size. In the highly collinear case, the posterior means converge to normally distributed random variables whose mean and variance depend on the prior means and prior precisions. The distribution degenerates to fixed points for either exact collinearity or strong identification. The analysis also suggests a diagnostic statistic for the highly collinear case. Monte Carlo simulations and an empirical example are used to illustrate the main findings.

[140] Andrew Phillip, Jennifer Chan, and Shelton Peiris. "On generalized bivariate student-t Gegenbauer long memory stochastic volatility models with leverage: Bayesian forecasting of cryptocurrencies with a focus on Bitcoin". In: *Econometrics and Statistics* (2018). In press. DOI: https://doi.org/10.1016/j.ecosta.2018.10.003.

Keywords: Gegenbauer long memory, Stochastic volatility, Leverage, Heavy tails, Cryptocurrency, Bitcoin.

Abstract: A Gegenbauer long memory stochastic volatility model with leverage and a bivariate Student's t-error distribution to model the innovations of the observation and latent volatility jointly for cryptocurrency time series is presented. This is inspired by the deep rooted characteristics found in cryptocurrencies. Until recently their econometric properties have not been thoroughly investigated. Thus, a rigorous in-sample simulation is conducted to assess the performance of the model with its nested alternatives and study the behavior of many cryptocurrencies and in particular Bitcoin. The data analysis is initiated with a broad scope of 114 cryptocurrencies, then a more detailed understanding of five of the most popular cryptocurrencies and followed up with forecasts focused specifically on

Bitcoin (while other forecasts are available as supplementary material). The model parameters are estimated with Bayesian approach using Markov Chain Monte Carlo sampling. In order to implement model selection, the Deviance Information Criterion (DIC) is used. Proposed models are compared with many popular models including those commonly used in industry. The models are applied in a Value-at-Risk (VaR) context and several measures are used to assess model performance.

[141] Silvia Platoni et al. "Heteroscedastic stratified two-way EC models of single equations and SUR systems". In: *Econometrics and Statistics* (2019). In press. DOI: https://doi.org/10.1016/j.ecosta.2019.03.004.

Keywords: Unbalanced panel, EC mode, SUR, Heteroscedasticity.

Abstract: A relevant issue in panel data estimation is heteroscedasticity, which often occurs when the sample is large and individual units are of varying size. Furthermore, many of the available panel data sets are unbalanced in nature, because of attrition or accretion, and micro-econometric models applied to panel data are frequently multi-equation models. The general least squares estimation of the heteroscedastic stratified two-way error component (EC) models of both single equations and seemingly unrelated regressions (SUR) systems (with cross-equation restrictions) on unbalanced panel data is considered. The derived heteroscedastic estimators of both single equations and SUR systems improve the estimation efficiency.

[142] D.S.G. Pollock. "Stochastic processes of limited frequency and the effects of oversampling". In: *Econometrics and Statistics* 7 (2018), pp. 18 –29. DOI: https://doi.org/10.1016/j.ecosta.2016.12.003.

Keywords: ARMA modelling, Stochastic differential equations, Frequency-limited stochastic processes, Oversampling.

Abstract: Discrete-time ARMA processes can be placed in a one-to-one correspondence with a set of continuous-time processes that are bounded in frequency by the Nyquist value of n radians per sample period. It is well known that, if data are sampled from a continuous process of which the maximum frequency exceeds the Nyquist value, then there will be a problem of aliasing. However, if the sampling is too rapid, then other problems will arise that may cause the ARMA estimates to be severely biased. The paper reveals the nature of these problems and it shows how they may be overcome.

[143] Federico Poloni and Giacomo Sbrana. “Closed-form results for vector moving average models with a univariate estimation approach”. In: *Econometrics and Statistics* 10 (2019), pp. 27 –52. DOI: https://doi.org/10.1016/j.ecosta.2018.06.003.
Keywords: VARMA estimation, Maximum likelihood, Canonical factorization.
Abstract: The estimation of a vector moving average (VMA) process represents a challenging task since the likelihood estimator is extremely slow to converge, even for small-dimensional systems. An alternative estimation method is provided, based on computing several aggregations of the variables of the system and applying likelihood estimators to the resulting univariate processes; the VMA parameters are then recovered using linear algebra tools. This avoids the complexity of maximizing the multivariate likelihood directly. Closed-form results are presented and used to compute the parameters of the process as a function of its autocovariances, using linear algebra tools. Then, an autocovariance estimation method based on the estimation of univariate models only is introduced. It is proved that the resulting estimator is consistent and asymptotically normal. A Monte Carlo simulation shows the good performance of this estimator in small samples.

[144] Zacharias Psaradakis and Marián Vávra. “A distance test of normality for a wide class of stationary processes”. In: *Econometrics and Statistics* 2 (2017), pp. 50 –60. DOI: https://doi.org/10.1016/j.ecosta.2016.11.005.
Keywords: Distance test, Fractionally integrated process, Sieve bootstrap, Normality.
Abstract: A distance test for normality of the one-dimensional marginal distribution of stationary fractionally integrated processes is considered. The test is implemented by using an autoregressive sieve bootstrap approximation to the null sampling distribution of the test statistic. The bootstrap-based test does not require knowledge of either the dependence parameter of the data or of the appropriate norming factor for the test statistic. The small-sample properties of the test are examined by means of Monte Carlo experiments. An application to real-world data is also presented.

[145] Jean-François Quessy and Martin Durocher. “The class of copulas arising from squared distributions: Properties and inference”. In: *Econo-*

metrics and Statistics 12 (2019), pp. 148 –166. DOI: https://doi.org/10.1016/j.ecosta.2019.02.002.
Keywords: Inversion of Kendall's tau estimator, Multivariate pairwise distributions, Pseudo likelihood estimators, Radial asymmetry, Upper tail dependence.
Abstract: A very general class of multivariate copulas is introduced. These copulas arise as the dependence structures that can be extracted from random vectors whose components are squared. The main theoretical properties of the new models are investigated and general formulas for the Kendall, Spearman and tail dependence measures are derived. The construction gives birth to new dependence models, including radially asymmetric versions of popular bivariate copulas like the Plackett, Frank and Normal dependence structures, as well as to the multivariate copulas of normal variance mixture models; the latter models are suitable in arbitrary dimensions and thus are attractive for multivariate, possibly high-dimensional, asymmetric dependence modeling. Suitably adapted parameter estimation strategies are also proposed and their properties are investigated with simulations. The newly introduced models and inferential tools are illustrated on the Nutrient dataset.

[146] Jeppe Rich. "A spline function class suitable for demand models". In: *Econometrics and Statistics* 14 (2020), pp. 24 –37. DOI: https://doi.org/10.1016/j.ecosta.2018.02.002.
Keywords: Discrete choice models, Multinomial logit, Functional form, Cost-damping, Spline functions.
Abstract: A function class suitable for estimating cost preferences in demand models is presented. The function class is applicable to any positive cost variable and is designed to be: (i) monotonically decreasing, (ii) to have decreasing marginal sensitivity with respect to cost, and (iii) to be differentiable at every point. It is shown how suitable functions can be formed from sequences of tailored functions in a manner that ensures their continuity and differentiability at the knot points. The proposed functions are well suited for demand models where price elasticities exhibit a damped pattern as the values of their argument increase. The usual linear-in-parameter functions or non-linear functions, such as the Box-Cox function, do not have an equally flexible way of accounting for such a pattern. This can be relevant when estimating transport demand models where the sensitivity of demand with respect to transport costs is known to decline

as the cost increases, i.e. the phenomenon of "cost-damping". However, it may also be relevant as a means to capture the marginal return of investments or declining marginal utility of income. To provide an illustration, the functions are incorporated in a multinomial logit model that is estimated from synthetically generated data by maximum likelihood. A Monte Carlo simulation study shows that the estimator is able to recover the true parameters.11The programs for generating the synthetic data and for estimating the models (in R and SAS software) are available as supplementary material to the electronic version of the paper. The practical application of the function class is also considered within the new large-scale Danish National Transport Model.

[147] Jeroen V.K. Rombouts, Lars Stentoft, and Francesco Violante. "Variance swap payoffs, risk premia and extreme market conditions". In: *Econometrics and Statistics* 13 (2020), pp. 106 –124. DOI: https://doi.org/10.1016/j.ecosta.2019.05.003.

Keywords: Variance risk premium, Variance swaps, Return predictability, Factor model, Kalman filter, CAPM.

Abstract: The variance risk premium (VRP) is estimated directly from synthetic variance swap payoffs. Since variance swap payoffs are highly volatile, the VRP is extracted by using signal extraction techniques based on a state-space representation of the model in combination with a simple economic constraint. The proposed approach, only requiring option implied volatilities and daily returns for the underlying asset, provides measurement error free estimates of the part of the VRP related to normal market conditions, and allows constructing variables indicating agents' expectations under extreme market conditions. The latter variables and the VRP generate different return predictability on the major US indices. A factor model is proposed to extract a market VRP which turns out to be priced when considering Fama and French portfolios.

[148] Elvezio Ronchetti. "Accurate and robust inference". In: *Econometrics and Statistics* 14 (2020), pp. 74 –88. DOI: https://doi.org/10.1016/j.ecosta.2019.12.003.

Keywords: Higher-order asymptotics, Relative error, Robustness, Saddlepoint methods, Stable inference.

Abstract: Classical statistical inference relies mostly on parametric models and on optimal procedures which are mostly justified by their asymptotic properties when the data generating process corresponds

to the assumed model. However, models are only ideal approximations to reality and deviations from the assumed model distribution are present on real data and can invalidate standard errors, confidence intervals, and p-values based on standard classical techniques. Moreover, the distributions needed to construct these quantities cannot typically be computed exactly and first-order asymptotic theory is used to approximate them. This can lead to a lack of accuracy, especially in the tails of the distribution, which are the regions of interest for inference. The interplay between these two issues is investigated and it is shown how to construct statistical procedures which are simultaneously robust and accurate.

[149] Peter Rousseeuw et al. "Robust Monitoring of Time Series with Application to Fraud Detection". In: *Econometrics and Statistics* 9 (2019), pp. 108 –121. DOI: https://doi.org/10.1016/j.ecosta.2018.05.001.

Keywords: Alternating least squares, Double wedge plot, Level shift, Outliers.

Abstract: Time series often contain outliers and level shifts or structural changes. These unexpected events are of the utmost importance in fraud detection, as they may pinpoint suspicious transactions. The presence of such unusual events can easily mislead conventional time series analysis and yield erroneous conclusions. A unified framework is provided for detecting outliers and level shifts in short time series that may have a seasonal pattern. The approach combines ideas from the FastLTS algorithm for robust regression with alternating least squares. The double wedge plot is proposed, a graphical display which indicates outliers and potential level shifts. The methodology was developed to detect potential fraud cases in time series of imports into the European Union, and is illustrated on two such series.

[150] D.K. Sakaria and J.E. Griffin. "On efficient Bayesian inference for models with stochastic volatility". In: *Econometrics and Statistics* 3 (2017), pp. 23 –33. DOI: https://doi.org/10.1016/j.ecosta.2016.08.002.

Keywords: Stochastic volatility, Bayesian methods, Markov chain Monte Carlo, Mixture offset representation.

Abstract: An efficient method for Bayesian inference in stochastic volatility models uses a linear state space representation to define a Gibbs sampler in which the volatilities are jointly updated. This method involves the choice of an offset parameter and we illustrate

how its choice can have an important effect on the posterior inference. A Metropolis–Hastings algorithm is developed to robustify this approach to choice of the offset parameter. The method is illustrated on simulated data with known parameters, the daily log returns of the Eurostoxx index and a Bayesian vector autoregressive model with stochastic volatility.

[151] Jhames M. Sampaio and Pedro A. Morettin. "Stable Randomized Generalized Autoregressive Conditional Heteroskedastic Models". In: *Econometrics and Statistics* (2018). In press. DOI: https://doi.org/10.1016/j.ecosta.2018.11.002.

Keywords: Indirect estimation, Stable distribution, SR-GARCH models, Autocovariation, Time series.

Abstract: The class of Randomized Generalized Autoregressive Conditional Heteroskedastic (R-GARCH) models represents a generalization of the GARCH models, adding a random term to the volatility with the purpose to better accommodate the heaviness of the tails expected for returns in the financial field. In fact, it is assumed that this term has stable distribution. Allowing both, returns and volatility, to have stable distribution, a new class of models to describe volatility arises: Stable Randomized Generalized Autoregressive Conditional Heteroskedastic Models (SR-GARCH). The indirect inference method is proposed to estimate the SR-GARCH parameters, theoretical results concerning dependence structure are obtained. Simulations and an empirical application are presented.

[152] Matthias Schmid, Gerhard Tutz, and Thomas Welchowski. "Discrimination measures for discrete time-to-event predictions". In: *Econometrics and Statistics* 7 (2018), pp. 153 –164. DOI: https://doi.org/10.1016/j.ecosta.2017.03.008.

Keywords: Concordance index, Discrete time-to-event data, Discrimination measures, Inverse probability weighting, Prediction, Survival analysis.

Abstract: Discrete time-to-event models have become a popular tool for the statistical analysis of longitudinal data. These models are useful when either time is intrinsically discrete or when continuous time-to-event outcomes are collected at pre-specified follow-up times, yielding interval-censored data. While there exists a variety of methods for discrete-time model building and estimation, measures for the evaluation of discrete time-to-event predictions are scarce. To address this issue, a set of measures that quantify the discrimina-

tory power of prediction rules for discrete event times is proposed. More specifically, sensitivity rates, specificity rates, AUC, and also a time-independent summary index ("concordance index") for discrete time-to-event outcomes are developed. Using inverse-probability-of-censoring weighting, it is shown how to consistently estimate the proposed measures from a set of censored data. To illustrate the proposed methodology, the duration of unemployment of US citizens is analyzed, and it is demonstrated how discrimination measures can be used for model comparison.

[153] Rene Segers, Philip Hans Franses, and Bert de Bruijn. "A novel approach to measuring consumer confidence". In: *Econometrics and Statistics* 4 (2017), pp. 121 –129. DOI: https://doi.org/10.1016/j.ecosta.2016.11.009.
Keywords: Consumer confidence, Randomized sampling, Markov transition model, Consumption.
Abstract: A new data collection method is put forward to measure daily consumer confidence at the individual level. The data thus obtained allow to statistically analyze the dynamic correlation of such a consumer confidence indicator and to draw inference on transition rates. The latter is not possible for currently available monthly data collected by statistical agencies on the basis of repeated cross-sections. In an application to measuring Dutch consumer confidence, results show that the incremental information content in the novel indicator helps to better forecast consumption.

[154] Raffaello Seri et al. "Model Calibration and Validation via Confidence Sets". In: *Econometrics and Statistics* (2020). In press. DOI: https://doi.org/10.1016/j.ecosta.2020.01.001.
Keywords: Calibration, Validation, Simulated models, Model confidence set, Large deviations.
Abstract: The issues of calibrating and validating a theoretical model are considered, when it is required to select the parameters that better approximate the data among a finite number of alternatives. Based on a user-defined loss function, Model Confidence Sets are proposed as a tool to restrict the number of plausible alternatives, and measure the uncertainty associated to the preferred model. Furthermore, an asymptotically exact logarithmic approximation of the probability of choosing a model via a multivariate rate function is suggested. A simple numerical procedure is outlined for the computation of the latter and it is shown that the procedure yields results

consistent with Model Confidence Sets. The illustration and implementation of the proposed approach is showcased in a model of inquisitiveness in ad hoc teams, relevant for bounded rationality and organizational research.11Code and data are available as an online supplement.

[155] Han Lin Shang. "Functional time series forecasting with dynamic updating: An application to intraday particulate matter concentration". In: *Econometrics and Statistics* 1 (2017), pp. 184 –200. DOI: https://doi.org/10.1016/j.ecosta.2016.08.004.
Keywords: Block moving, Dynamic updating, Functional principal component regression, Functional linear regression, Maximum entropy bootstrap, VAR.
Abstract: Environmental data often take the form of a collection of curves observed sequentially over time. An example of this includes daily pollution measurement curves describing the concentration of a particulate matter in ambient air. These curves can be viewed as a time series of functions observed at equally spaced intervals over a dense grid. The nature of high-dimensional data poses challenges from a statistical aspect, due to the so-called "curse of dimensionality", but it also poses opportunities to analyze a rich source of information to better understand dynamic changes at short time intervals. Statistical methods are introduced and compared for forecasting one-day-ahead intraday concentrations of particulate matter; as new data are sequentially observed, dynamic updating methods are proposed to update point and interval forecasts to achieve better accuracy. These forecasting methods are validated through an empirical study of half-hourly concentrations of airborne particulate matter in Graz, Austria.

[156] Shinichiro Shirota et al. "Cholesky realized stochastic volatility model". In: *Econometrics and Statistics* 3 (2017), pp. 34 –59. DOI: https://doi.org/10.1016/j.ecosta.2016.08.003.
Keywords: Cholesky stochastic volatility model, Dynamic correlations, Leverage effect, Markov chain Monte Carlo, Realized covariances.
Abstract: Multivariate stochastic volatility models with leverage are expected to play important roles in financial applications such as asset allocation and risk management. However, these models suffer from two major difficulties: (1) there are too many parameters to estimate by using only daily asset returns and (2) estimated covariance

matrices are not guaranteed to be positive definite. Our approach takes advantage of realized covariances to achieve the efficient estimation of parameters by incorporating additional information for the covolatilities, and considers Cholesky decomposition to guarantee the positive definiteness of the covariance matrices. In this framework, a flexible model is proposed for stylized facts of financial markets, such as dynamic correlations and leverage effects among volatilities. By using the Bayesian approach, Markov Chain Monte Carlo implementation is described with a simple but efficient sampling scheme. Our model is applied to the data of nine U.S. stock returns, and it is compared with other models on the basis of portfolio performances.

[157] Rosaria Simone, Gerhard Tutz, and Maria Iannario. "Subjective heterogeneity in response attitude for multivariate ordinal outcomes". In: *Econometrics and Statistics* 14 (2020), pp. 145 –158. DOI: https://doi.org/10.1016/j.ecosta.2019.04.002.

Keywords: Random effects, Mixture models, Rating data, Subjective uncertainty.

Abstract: Traditional statistical models with random effects account for heterogeneity in the population with respect to the location of the response in a subject-specific way. This approach ignores that also uncertainty of the responses can vary across individuals and items: for example, subject-specific indecision may play a role in the rating process relative to questionnaire items. In this setting, a generalized mixture model is advanced that accounts for subjective heterogeneity in response behaviour for multivariate ordinal responses: to this aim, random effects are specified for the individual propensity to a structured or an uncertain response attitude. Simulations and a case study illustrate the effectiveness of the proposed model and its implications.

[158] A. Skripnikov and G. Michailidis. "Joint estimation of multiple network Granger causal models". In: *Econometrics and Statistics* 10 (2019), pp. 120 –133. DOI: https://doi.org/10.1016/j.ecosta.2018.08.001.

Keywords: Alternating direction method of multipliers, Factor covariance, Generalized fused lasso, Sparse estimation, Vector autoregression.

Abstract: Joint regularized modeling framework is presented for the estimation of multiple Granger causal networks. High-dimensional network Granger models focus on learning the corresponding causal effects amongst a large set of distinct time series. They are oper-

ationalized through the formalism of Vector Autoregressive Models (VAR). The latter represent a popular class of time series models that has been widely used in applied econometrics and finance. In particular, the setting of the same set of variables being measured on different entities over time is considered (e.g. same set of economic indicators for multiple US states). Moreover, the covariance structure of the error term is assumed to exhibit low rank structure which can be recovered by a factor model. The framework allows to account for both sparsity and potential similarities between the related networks by introducing appropriate structural penalties on the transition matrices of the corresponding VAR models. An alternating directions method of multipliers (ADMM) algorithm is developed for solving the underlying joint estimation optimization problem. The performance of the joint estimation method is evaluated on synthetic data and illustrated on an application involving economic indicators for multiple US states11Code and data are available as online supplement..

[159] Aleksandar Sujica and Ingrid Van Keilegom. "The copula-graphic estimator in censored nonparametric location-scale regression models". In: *Econometrics and Statistics* 7 (2018), pp. 89 –114. DOI: https://doi.org/10.1016/j.ecosta.2017.07.002.
Keywords: Asymptotic normality, Asymptotic representation, Copula, Dependent censoring, Kernel estimator, Nonparametric regression, Right censoring.
Abstract: A common assumption when working with randomly right censored data, is the independence between the variable of interest Y (the survival time) and the censoring variable C. This assumption, which is not testable, is however unrealistic in certain situations. Let us assume that for a given covariate X, the dependence between the variables Y and C is described via a known copula. Additionally assume that Y is the response variable of a heteroscedastic regression model $Y = m(X) + \sigma(X)\epsilon$, where the error term ϵ is independent of the explanatory variable X, and the functions m and σ are 'smooth'. An estimator of the conditional distribution of Y given X under this model is then proposed, and the asymptotic normality of this estimator is shown. The small sample performance of the estimator is also studied, and the advantages/drawbacks of this estimator with respect to competing estimators are discussed.

[160] Yanqing Sun, Yuanqing Zhang, and Jianhua Z. Huang. "Estimation

of a semiparametric varying-coefficient mixed regressive spatial autoregressive model". In: *Econometrics and Statistics* 9 (2019), pp. 140 –155. DOI: https://doi.org/10.1016/j.ecosta.2017.05.005.
Keywords: Asymptotic theory, Semiparametric varying coefficient, Series approximation, Spatial mixed regression, Teen pregnancy analysis, Two-stage least squares estimation.
Abstract: A semiparametric varying-coefficient mixed regressive spatial autoregressive model is used to study covariate effects on spatially dependent responses, where the effects of some covariates are allowed to vary with other variables. A semiparametric series-based least squares estimating procedure is proposed with the introduction of instrumental variables and series approximations of the conditional expectations. The estimators for both the nonparametric and parametric components of the model are shown to be consistent and their asymptotic distributions are derived. The proposed estimators perform well in simulations. The proposed method is applied to analyze a data set on teen pregnancy to investigate effects of neighborhood as well as other social and economic factors on the teen pregnancy rate.

[161] Maxwell Sutton, Andrey L. Vasnev, and Richard Gerlach. "Mixed interval realized variance: A robust estimator of stock price volatility". In: *Econometrics and Statistics* 11 (2019), pp. 43 –62. DOI: https://doi.org/10.1016/j.ecosta.2018.06.001.
Keywords: Volatility, Robust estimator.
Abstract: An ex post volatility estimator, called mixed interval realized variance (MIRV), is proposed. The estimator uses high-frequency price data to provide measurements robust to the idiosyncratic noise of stock markets caused by the bid-ask bounce. The theoretical properties of the new volatility estimator are illustrated and compared with those of the two canonical realized measures: realized volatility and realized range. A simulation study adds to this comparison and highlights some favorable robustness properties of the new estimator when subject to market microstructures. The main finding is that mixed interval realized variance is robust to the presence of microstructures, but inconsistent in the hypothetical ideal scenario. The empirical illustration features Australian stocks from the ASX 20 and provides evidence that for a number of stocks the mixed interval realized variance is competitive with other realized measures

under predictive likelihood when it is included in a Realized GARCH model.

[162] Xiaojun Tong, Zhuoqiong Chong He, and Dongchu Sun. "Estimating Chinese Treasury yield curves with Bayesian smoothing splines". In: *Econometrics and Statistics* 8 (2018), pp. 94 –124. DOI: https://doi.org/10.1016/j.ecosta.2017.10.001.
Keywords: Yield curve estimation, Chinese Treasury bond, Bayesian smoothing splines.
Abstract: An improved Bayesian smoothing spline (BSS) model is developed to estimate the term structure of Chinese Treasury yield curves. The developed BSS model has a flexible function form which can model various yield curve shapes. As a nonparametric method different from Jarrow–Ruppert–Yu's penalized splines, the BSS model does not need to choose the number of and locations for knots. Instead, this BSS model obtains the smoothing parameter as a by-product that does not need to be estimated. Furthermore, a dimension reduction procedure is developed to calculate an inverse matrix when implementing this BSS model. Finally, simulation results and an application illustrate the BSS model outperforms traditional parametric models and the penalized spline model.

[163] G. Tutz and M. Berger. "Separating location and dispersion in ordinal regression models". In: *Econometrics and Statistics* 2 (2017), pp. 131 –148. DOI: https://doi.org/10.1016/j.ecosta.2016.10.002.
Keywords: Proportional odds model, Location-scale model, Location-shift model, Ordinal response models, Dispersion modeling.
Abstract: In ordinal regression the focus is typically on location effects, potential variation in the distribution of the probability mass over response categories referring to stronger or weaker concentration in the middle is mostly ignored. If dispersion effects are present but ignored goodness-of-fit suffers and, more severely, biased estimates of location effects are to be expected since ordinal regression models are non-linear. A model is proposed that explicitly links varying dispersion to explanatory variables. It is able to explain why frequently some variables are found to have category-specific effects. The embedding into the framework of multivariate generalized linear models allows to use computational tools and asymptotic results that have been developed for this class of models. The model is compared to alternative approaches in applications and simulations. In addition,

a visualization tool for the combination of location and dispersion effects is proposed and used in applications.

[164] Gerhard Tutz and Moritz Berger. "The effect of explanatory variables on income: A tool that allows a closer look at the differences in income". In: *Econometrics and Statistics* (2018). In press. DOI: https://doi.org/10.1016/j.ecosta.2018.12.001.
Keywords: Income, Sequential model, Discrete hazard model, Varying coefficients, Ordinal models.
Abstract: Investigation of the effect of covariates on income typically relies on regression models with a transformed income. An underlying assumption is that the exact income is available. However, in surveys reported income is often available in income brackets only. For such grouped data one can use ordered regression models, which in their simplest form with a linear predictor work in a similar way as regression models for exact income. They yield an overall measure of the effect of covariates but fail to detect the specific structure of the effects of single covariates. A model is proposed that allows a closer look at the effect of single covariates, showing in more detail how the income is determined by explanatory variables. The model exploits the potential of sequential regression models, which are extended to allow for varying coefficients. The model is not harder to use than classical regression models but is much more informative. The method is illustrated by using data from the German Socio-Economic Panel Study and the United States Census Bureau.

[165] Catalina A. Vallejos and Mark F.J. Steel. "Incorporating unobserved heterogeneity in Weibull survival models: A Bayesian approach". In: *Econometrics and Statistics* 3 (2017), pp. 73 –88. DOI: https://doi.org/10.1016/j.ecosta.2017.01.005.
Keywords: Survival analysis, Frailty model, Robust modelling, Outlier detection, Posterior existence.
Abstract: Outlying observations and other forms of unobserved heterogeneity can distort inference for survival datasets. The family of Rate Mixtures of Weibull distributions includes subject-level frailty terms as a solution to this issue. With a parametric mixing distribution assigned to the frailties, this family generates flexible hazard functions. Covariates are introduced via an Accelerated Failure Time specification for which the interpretation of the regression coefficients does not depend on the choice of mixing distribution. A weakly informative prior is proposed by combining the structure of the Jeffreys

prior with a proper prior on some model parameters. This improper prior is shown to lead to a proper posterior distribution under easily satisfied conditions. By eliciting the proper component of the prior through the coefficient of variation of the survival times, prior information is matched for different mixing distributions. Posterior inference on subject-level frailty terms is exploited as a tool for outlier detection. Finally, the proposed methodology is illustrated using two real datasets, one concerning bone marrow transplants and another on cerebral palsy.

[166] Meng Wang, Zhao Chen, and Christina Dan Wang. "Composite quantile regression for GARCH models using high-frequency data". In: *Econometrics and Statistics* 7 (2018), pp. 115 –133. DOI: https://doi.org/10.1016/j.ecosta.2016.11.004.
Keywords: GARCH models, Composite quantile regression, Volatility proxy, High-frequency data, Robustness, Asymptotic normality, Efficiency.
Abstract: The composite quantile regression (CQR) method is newly proposed to estimate the generalized autoregressive conditional heteroskedasticity (GARCH) models, with the help of high-frequency data. High-frequency intraday log-return processes are embedded into the daily GARCH models to generate the corresponding volatility proxies. Based on proxies, the parameter estimation of GARCH model is derived through the composite quantile regression. The consistency and the asymptotic normality of the proposed estimator are obtained under mild conditions on the innovation processes. To examine the finite sample performance of our newly proposed method, simulation studies are conducted with comparison to several existing estimators of the GARCH model. From the simulation studies, it can be concluded that the proposed CQR estimator is robust and more efficient. An empirical analysis on high-frequency data is presented to illustrate the new methodology.

[167] Damien C.H. Wee, Feng Chen, and William T.M. Dunsmuir. "Likelihood inference for Markov switching GARCH(1,1) models using sequential Monte Carlo". In: *Econometrics and Statistics* (2020). In press. DOI: https://doi.org/10.1016/j.ecosta.2020.03.004.
Keywords: Regime switching, Missing data, Intractable likelihood, Particle filter, Time series, Volatility modelling.
Abstract: Markov switching (MS-)GARCH(1,1) models allow for structural changes in volatility dynamics between a finite number of

regimes. Since the regimes are not observed, computation of the likelihood requires integrating over an exponentially increasing number of regime paths, which is intractable. An existing smooth likelihood estimation procedure for sequential Monte Carlo (SMC), that is currently limited to hidden Markov models with a one-dimensional state variable, is modified to enable likelihood estimation and maximisation for MS-GARCH(1,1) models, a model which requires two dimensions, volatility and regime, to evolve its hidden state process. Furthermore, the modified SMC procedure is shown to be easily adapted to fitting MS-GARCH(1,1) models even when there are missing observations. The proposed methodology is validated with simulated data and is also illustrated with analysis of two financial time series, the daily returns on the S&P 500 index and on the Henry Hub natural gas spot price, with the latter series containing a gap caused by shutdown in response to hurricane Rita in 2005.

[168] Kai Wenger and Christian Leschinski. "Fixed-bandwidth CUSUM tests under long memory". In: *Econometrics and Statistics* (2019). In press. DOI: https://doi.org/10.1016/j.ecosta.2019.08.001.
Keywords: Fixed-bandwidth asymptotics, Fractional integration, Long memory, Structural breaks.
Abstract: A family of self-normalized CUSUM tests for structural change under long memory is proposed. The test statistics apply nonparametric kernel-based long-run variance estimators and have well-defined limiting distributions that only depend on the long-memory parameter. A Monte Carlo simulation shows that these tests provide finite sample size control while outperforming competing procedures in terms of power.

[169] Ximing Wu and Robin Sickles. "Semiparametric estimation under shape constraints". In: *Econometrics and Statistics* 6 (2018). STATISTICS OF EXTREMES AND APPLICATIONS, pp. 74 –89. DOI: https://doi.org/10.1016/j.ecosta.2017.06.001.
Keywords: Monotonicity, Concavity, Shape constraints, Semiparametric estimation, Penalized splines, Lorenz curve, Production functions.
Abstract: Substantial structure and restrictions, such as monotonicity and curvature constraints, necessary to give economic interpretation to empirical findings are often furnished by economic theories. Although such restrictions may be imposed in certain parametric empirical settings in a relatively straightforward fashion, incorporating

such restrictions in semiparametric models is often problematic. A solution to this problem is provided via penalized splines, where monotonicity and curvature constraints are maintained through integral transformations of spline basis expansions. Large sample properties, implementation and inferential procedures are presented. Extension to multiple regressions under the framework of additive models is also discussed. A series of Monte Carlo simulations illustrate the finite sample properties of the estimator. The proposed method is employed to estimate a Lorenz curve of income and a production function with multiple inputs.

[170] Takuma Yoshida. "Semiparametric method for model structure discovery in additive regression models". In: *Econometrics and Statistics* 5 (2018), pp. 124 –136. DOI: https://doi.org/10.1016/j.ecosta.2017.02.005.

Keywords: Adaptive group lasso, Additive model, Parametric guided estimation, Parametric model discovery, Spline smoothing.

Abstract: In regression analysis, there are two typical approaches, parametric methods and nonparametric methods. If the prior information of the structure of the regression function is obtained, a parametric method is preferred since they are efficient and easily interpreted. When the model is misspecified, on the other hand, parametric estimators do not work well. Therefore, it is important to check whether the parametric model assumption is valid. To simultaneously discover the model structure and estimate the regression function in additive regression models, a new semiparametric method is proposed. First, a parametric model is prepared and its estimator is obtained for all additive components. Next, for the residual data associated with the parametric estimator, a nonparametric method is applied. The final estimator is constructed by summing the parametric estimator and the nonparametric estimator of the residual data. In the second-step estimation, the B-spline method with an adaptive group lasso penalty is utilized. For each additive component, if the nonparametric estimator becomes the zero function, the final estimator is reduced to a parametric estimator. In other words, the model structure can then be discovered. The asymptotic properties of the proposed estimator are shown. A numerical study via a Monte Carlo simulation and a real data application are presented.

[171] Liang Zhang, Tianming Zhu, and Jin-Ting Zhang. "A Simple Scale-Invariant Two-Sample Test for High-dimensional Data". In: *Econo-*

metrics and Statistics 14 (2020), pp. 131 –144. DOI: https://doi.org/10.1016/j.ecosta.2019.12.002.
Keywords: High-dimensional data, Scale-invariant test, -type mixture, Two-sample test, Welch-satterthwaite -approximation.
Abstract: A new scale-invariant test for two-sample problems for high-dimensional data is proposed and studied. Under some regularity conditions and the null hypothesis, the proposed test statistic and a chi-square-type mixture are shown to have the same limiting distribution after they are normalized. The limiting distribution can be normal or non-normal, depending on the underlying covariance structure of the high-dimensional data. To approximate the null distribution of the proposed test, the well-known Welch-Satterthwaite chi-square approximation is applied. The resulting test is shown to be adaptive to the shape of the underlying null distribution in the sense that when the test statistic is asymptotically normally distributed under the null hypothesis, so is the approximation distribution, and when the approximation distribution is asymptotically non-normally distributed, so is the underlying null distribution of the test statistic. The asymptotic powers of the proposed test under some local alternatives are derived. Simulation studies and a real data application are used to demonstrate the good performance of the proposed test compared with several existing competitors in the literature.

[172] Yonghui Zhang and Qiankun Zhou. "Estimation for time-invariant effects in dynamic panel data models with application to income dynamics". In: *Econometrics and Statistics* 9 (2019), pp. 62 –77. DOI: https://doi.org/10.1016/j.ecosta.2017.10.002.
Keywords: Dynamic panel, GMM, OLS, Time-invariant effects, Return to schooling.
Abstract: A two-step estimation procedure is proposed to estimate the time-invariant effects, i.e., the slopes of the time-invariant regressors, in dynamic panel data models. In the first step, generalized method of moments (GMM) is used to estimate the time-varying effects, and the second step is to run cross-sectional OLS regression of the time series average of the residuals from the GMM estimation on the time-invariant regressors to estimate the time-invariant effects. It is shown that the OLS estimator of time-invariant effects is N-consistent and asymptotically normally distributed. A consistent estimator for the asymptotic variance of the estimator is also provided, which is robust to errors with heteroscedasticity and works well even

if the errors are serially correlated. Monte Carlo simulations confirm the theoretical findings. Application to income dynamics highlights the importance of estimating time-invariant effects such as education, race and gender in return to schooling.

[173] Yixing Zhao, Rogemar Mamon, and Huan Gao. "A two-decrement model for the valuation and risk measurement of a guaranteed annuity option". In: *Econometrics and Statistics* 8 (2018), pp. 231 –249. DOI: https://doi.org/10.1016/j.ecosta.2018.06.004.
Keywords: Stochastic model, Lapse rate, Change of probability measure, Risk measure, Moment-based density approximation.
Abstract: The lapse risk arising from the termination of policies, due to a variety of causes, has significant influence on the prices of contracts, liquidity of an insurer, and the reserves necessary to meet regulatory capital. The aim is to address in an integrated manner the problem of pricing and determining the capital requirements for a guaranteed annuity option when lapse risk is embedded in the modelling framework. In particular, two decrements are considered in which death and policy lapse occurrences with their correlations to the financial risk are explicitly modelled. A series of probability measure changes is employed and the corresponding forward, survival, and risk-endowment measures are constructed. This approach superbly circumvents the rather slow "simulation-within-simulation" pricing procedure under a stochastic setting. Implementation results illustrate that the proposed approach cuts down the Monte-Carlo simulation technique's average computing time by 99%. Risk measures are computed using the moment-based density method and benchmarked against the Monte-Carlo-based numerical findings. Depending on the risk metric used (e.g., VaR, CVaR, various forms of distortion risk measures) and the correlation between the interest and lapse rates, the capital requirement may substantially change, which could be either an increase or decrease of up to 50%.

[174] Nan Zou and Dimitris N. Politis. "Bootstrap seasonal unit root test under periodic variation". In: *Econometrics and Statistics* (2020). In press. DOI: https://doi.org/10.1016/j.ecosta.2020.01.002.
Keywords: Seasonality, Unit root, AR sieve bootstrap, Block bootstrap, Functional central limit theorem.
Abstract: Both seasonal unit roots and periodic variation can be prevalent in seasonal data. In the testing of seasonal unit roots under periodic variation, the validity of the existing methods, such as

the HEGY test, remains unknown. The behavior of the augmented HEGY test and the unaugmented HEGY test under periodic variation is analyzed. It turns out that the asymptotic null distributions of the HEGY statistics testing the single roots at 1 or -1 when there is periodic variation are identical to the asymptotic null distributions when there is no periodic variation. On the other hand, the asymptotic null distributions of the statistics testing any coexistence of roots at 1, -1, i, or -i when there is periodic variation are non-standard and are different from the asymptotic null distributions when there is no periodic variation. Therefore, when periodic variation exists, HEGY tests are not directly applicable to the joint tests for any concurrence of seasonal unit roots. As a remedy, bootstrap is proposed; in particular, the augmented HEGY test with seasonal independent and identically distributed (iid) bootstrap and the unaugmented HEGY test with seasonal block bootstrap are implemented. The consistency of these bootstrap procedures is established. The finite-sample behavior of these bootstrap tests is illustrated via simulation and prevails over their competitors'. Finally, these bootstrap tests are applied to detect the seasonal unit roots in various economic time series.

List of Keywords