

3rd Annual Workshop on Financial Econometrics

Örebro, Sweden

November 11 - 12, 2019



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Preface

The School of Business at Örebro University and Kommuninvest are jointly arranging the third annual two-day workshop on financial econometrics. The workshop will cover a broad range of topics in financial econometrics, both theoretical and empirical. These include, but are not restricted to:

- Return predictability
- Interest rate modelling
- Volatility and risk modelling
- Non-Gaussian models in finance
- Bayesian econometrics

Workshop venue:

All the sessions will be held in the Stora Elite Hotel. The venue is located very close to the Örebro Castle.

Time for presentation:

- Length of a keynote talk is 60 minutes, including discussion.
- Length of a contributed talk is 30 minutes, including discussion.

Lunches:

Day 1 and 2 will be served at Stora Elite Hotel.

Workshop dinner:

Workshop dinner on Monday evening is held in the Örebro Castle, which is located in the city center. Dinner starts at 18:30.

Program Overview

Monday, Nov 11

09:00 – 09:30	Registration
09:30 – 09:35	Welcome Note
09:35 – 11:05	Session 1: Volatility Modelling I
11:05 – 11:25	Coffee Break
11:25 – 12:25	Keynote Lecture: Prof. Peter R. Hansen
12:25 – 13:30	Lunch
13:30 – 15:00	Session 2: Volatility Modelling II
15:00 – 15:20	Coffee Break
15:20 – 16:50	Session 3: Bayesian Econometrics
18:30	Workshop Dinner

Tuesday, Nov 12

09:00 – 10:00	Session 4: Forecasting
10:00 – 10:30	Coffee Break
10:30 – 12:00	Session 5: Portfolio Theory
12:00 – 13:00	Lunch
13:00 – 14:00	Session 6: Asset Pricing
14:00 – 14:10	Concluding Remarks

Detailed Program

Monday, Nov 11

09:00 – 09:30	Registration
09:30 – 09:35	Welcome Note Prof. Sune Karlsson
09:35 – 11:05	Session 1 (Volatility Modelling I) Chair: Farrukh Javed Krzysztof Podgórski: Volatility Leverage ARCH Models with Non-Gaussian Shocks Nader Virk: A Reality Check on GARCH-MIDAS Models Lu Liu: Structural Multivariate Spatial Econometrics: Application to Cross-Country Interdependence of Stock and Bond Markets
11:05 – 11:25	Coffee Break
11:25 – 12:25	Keynote Lecture Chair: Pär Österholm Prof. Peter R. Hansen (University of North Carolina, Chapel Hill, USA) Title: A Multivariate Realized GARCH Model
12:25 – 13:30	Lunch
13:30 – 15:00	Session 2 (Volatility Modelling II) Chair: Tamás Kiss Gustav Alfelt: Singular Conditional Autoregressive Wishart Model Yuze Liu: Improved and Extended Nowcasting Techniques for Financial Volatility Anne Lundgaard Hansen: Yield Curve Volatility and Macro Risks

15:00 – 15:20	Coffee Break
15:20 – 16:50	Session 3 (Bayesian Econometrics) Chair: Sune Karlsson Agnieszka Borowska: Partially Censored Posterior for Robust and Efficient Risk Evaluation Taras Bodnar: Bayesian Inference of the Multi-Period Optimal Portfolio for an Exponential Utility David Kohns: Interpreting Big Data in the Macro Economy: A Bayesian Mixed Frequency Estimator
18:30	Workshop Dinner (The Örebro Castle)

Tuesday, Nov 12

09:00 – 10:00	Session 4 (Forecasting) Chair: Hoang Nguyen Julie Schnaitmann: Forecast Encompassing Tests for the Expected Shortfall Tamás Kiss: Long-run Predictability Tests are Even Worse than You Thought
10:00 – 10:30	Coffee Break
10:30 – 12:00	Session 5 (Portfolio Theory) Chair: Stepan Mazur Erik Thorsén: Sampling Distributions of Optimal Portfolio Weights and Characteristics in Low and Large Dimensions Maziar Sahamkhadam: Dynamic Black-Litterman Copula-based Optimal Portfolios with Tail Constraints Laura Reh: Dynamic Modeling of the Global Minimum Variance Portfolio Weights
12:00 – 13:00	Lunch
13:00 – 14:00	Session 6 (Asset Pricing) Chair: Kamil Kladivko Tommy von Brömsen: The Global Interest Rate Differential and the Dollar Carry Trade Daniele Bianchi: Sparsity in Expected Returns
14:00 – 14:10	Concluding Remarks Prof. Pär Österholm

Abstracts

Keynote Speaker:

A Multivariate Realized GARCH Model

Peter R. Hansen

University of North Carolina, Chapel Hill, USA

11 Nov
11:25-12:25

We propose a novel class of multivariate Realized GARCH models that utilize realized measures of volatility and correlations. The key property of the model is a convenient parametrization of the correlation matrix that requires no additional structure to ensure positive definiteness. The correlation matrix is characterized by a vector, ϱ_t , that can vary freely in the real vector space, \mathbb{R}^d . A more parsimonious structure is often desired in practice, in particularly in high dimensional systems, and the framework facilitates simple and intuitive dimension reductions. We apply the model to returns of nine assets and illustrate a dimension reduction that arises from a natural block equicorrelation structure.

Contributed Talks:

11 Nov
09:35-10:05

Volatility Leverage ARCH Models with Non-Gaussian Shocks

Farrukh Javed¹, Krzysztof Podgórski²

¹Örebro University School of Business; ²Lund University

We propose a new model that accounts for the asymmetric response of volatility to positive ('good news') and negative ('bad news') shocks in economic time series – the so-called leverage effect. In the past, asymmetric powers of errors in the conditionally heteroskedastic models have been used to capture this effect. Our model is using the gamma difference representation of the generalized Laplace distributions that efficiently models the asymmetry. It has one additional natural parameter, the shape, that is used instead of power in the asymmetric power models to capture the strength of a long-lasting effect of shocks. Some fundamental properties of the model are provided including the formula for covariances and an explicit form for the conditional distribution of 'bad' and 'good' news processes given the past – the property that is important for statistical fitting of the model. Relevant features of volatility models are illustrated using S&P 500 historical data.

11 Nov
10:05-10:35

A Reality Check on GARCH-MIDAS Models

Nader Virk¹, Farrukh Javed², Basel Awartani³

¹Plymouth Business School; ²Örebro University School of Business; ³Westminster Business School

We employ a battery of model evaluation tests and account for the data snooping to evaluate several GARCH-MIDAS models. We document that inferences based on standard tests for GM variance components can be misleading. Our data mining free results show that the gains of macro-variables in forecasting total (long run) variance by GM models are overstated (understated). It is important know different components of volatility for different investing styles and pricing of derivative securities and therefore, researchers should be wary of data mining bias, which may contaminate a forecast that may appear statistically validated using robust evaluation tests.

Structural Multivariate Spatial Econometrics: Application to Cross-Country Interdependence of Stock and Bond Markets

Hossein Asgharian¹, **Lu Liu**², Krzysztof Podgórski¹, Nima Shariati¹

¹Lund University; ²Stockholm University

11 Nov
10:35-11:05

We develop a structural multivariate spatial regression model allowing us to incorporate both inter- and intralocation effects among different variables. The existing multivariate spatial regression approaches are not able to simultaneously account for these effects. The currently available models either ignore the intralocation effect between the variables, which may result to bias in estimation of the other effect, or estimate a reduced form without separating the two effects. We employ this model to investigate the comovements of international stock and bond markets using geographic neighborhood and bilateral trade between countries to define countries' proximity to each other. Our results show that eliminating the within-country effect between stock and bond returns may lead to estimation bias and misrepresentation of cross-country feedback effects of these variables. We find a strong spatial dependence between stock returns, particularly for countries that have large trades with each other. The spatial dependence between countries' bond returns is also highly significant but the magnitude of the effect is smaller than that of stock returns. We show that this correlation is mainly due to the global comovement of the bond markets rather than the interdependence of the countries through the proximities employed in this paper. Moreover, we find a positive within-country and a negative cross-country dependence between stock and bond returns.

Singular Conditional Autoregressive Wishart Model

Gustav Alfelt¹, Taras Bodnar¹, Farrukh Javed², Joanna Tyrcha¹

¹Stockholm University; ²Örebro University School of Business

11 Nov
13:30-14:00

In this paper we suggest a Singular Conditional Autoregressive Wishart (SCAW) model to capture the dynamics of singular realized covariance matrices of asset returns. Such singularity arises in high-dimensional cases where the dimension of the return process exceeds the number of intraday returns sampled each day. The model assumes that the non-singular scale matrix of the underlying Singular Wishart process follows an autoregressive moving average structure with a BEKK specification, and can be estimated by the Maximum Likelihood method. In order to facilitate feasible estimation in high-dimensional cases, we also suggest fitting the model to a transformation of the data series and applying covariance targeting. Finally the model is applied to high-frequency data from AMEX, NASDAQ and NYSE, and is evaluated by out-of-sample forecast accuracy.

Improved and Extended Nowcasting Techniques for Financial Volatility

Yuze Liu¹, Robinson Kruse-Becher^{1,2,3}

¹University of Cologne; ²University of Bonn; ³CREATES, Aarhus University

Recently, a simple model for nowcasting daily financial log-volatility has been proposed. In contrast to existing approaches, it uses current and past information. Fortunately, it obeys a simple ARMA representation for log-squared returns and is related to the well-known Stochastic Volatility model. The suggested nowcasting model outperforms the EGARCH model and the SV model. However, there are some important limitations. First, the maximum likelihood estimation under a Gaussian approximation is biased and inefficient in finite-samples. It can be expected that improvements are achievable in terms of finite-sample bias and efficiency by considering explicitly the non-Gaussianity of log squared returns which are highly skewed and also leptokurtic. Second, the model allows only for first-order autoregressive dynamics which is typically too restrictive to capture the dynamics of log-volatility series. Third, the nowcasting methodology is univariate and a multivariate extension would be desirable in times of big data and high-dimensional asset markets. Our estimation approach follows Kitagawa (Kitagawa (1987), Kitagawa (2010)) and implements a state-space filter. It implements the numerical exact ML estimation under non-Gaussian distributions and non-linearity. In an extensive Monte Carlo study, bias-reduction and efficiency gains are investigated. The volatility nowcasting performance is evaluated by means of MSE and a pseudo- R^2 measure. In an empirical application, volatilities of three major US stock indices (Dow Jones, Standard and Poors and Nasdaq) are nowcasted more accurately in comparison to the existing approaches.

Bibliography

1. Kitagawa G. 1987. Non-Gaussian state-space modeling of nonstationary time series. *Journal of the American Statistical Association* 82: 1032-1041.
2. Kitagawa G. 2010. *Introduction to time series modeling*. Chapman and Hall/CRC.

Yield Curve Volatility and Macro Risks

Anne Lundgaard Hansen
University of Copenhagen

11 Nov
14:30-15:00

We show that the role of macro risks in the yield curve varies substantially over time. For this purpose, we introduce a novel no-arbitrage macro-finance term structure model with multivariate GARCH volatility and a second-order pricing kernel. Our model is tractable and captures empirical measures of volatility in U.S. Treasury bond yields between 1971 and 2019 closely. We find that the fraction of yield curve variation due to macro risks ranges between 0 and 56 pct with large month-to-month changes. For short-term yields, the importance of macro risks ceased during the Great Moderation but regained explanatory power after the Great Recession. Macro risks primarily explain movements in long-term yields through expected short rates. This relationship has strengthened over our sample, while the link between term premia and the macroeconomy has weakened. Finally, we show that macro risks explain most yield curve variation during expansions. Overall, our results insist on the importance of state-dependent models and methods in macro-finance.

Partially Censored Posterior for Robust and Efficient Risk Evaluation

Agnieszka Borowska^{1,2}, Lennart Hoogerheide^{1,2}, Siem Jan Koopman^{1,2,3},
Herman K. van Dijk^{2,4,5}

11 Nov
15:20-15:50

¹Vrije Universiteit Amsterdam; ²Tinbergen Institute; ³CREATES, Aarhus University;
⁴Erasmus University Rotterdam; ⁵Norges Bank

A novel approach to inference for a specific region of the predictive distribution is introduced. An important domain of application is accurate prediction of financial risk measures, where the area of interest is the left tail of the predictive density of logreturns. Our proposed approach originates from the Bayesian approach to parameter estimation and time series forecasting, however it is robust in the sense that it provides a more accurate estimation of the predictive density in the region of interest in case of misspecification. The first main contribution of the paper is the novel concept of the Partially Censored Posterior (PCP), where the set of model parameters is partitioned into two subsets: for the first subset of parameters we consider the standard marginal posterior, for the second subset of parameters (that are particularly related to the region of interest) we consider the conditional censored posterior. The censoring means that observations outside the region of interest are censored: for those observations only the probability of being outside the region of interest matters. This quasi-Bayesian approach yields more precise parameter estimation than a fully censored posterior for all parameters, and has more focus on the region of interest than a standard Bayesian approach. The second main contribution is that we introduce two novel methods for computationally efficient simulation: Conditional MitISEM, a Markov chain Monte Carlo method to simulate model parameters from the Partially Censored Posterior, and PCP-QERMit, an

Importance Sampling method that is introduced to further decrease the numerical standard errors of the Value-at-Risk and Expected Shortfall estimators. The third main contribution is that we consider the effect of using a time-varying boundary of the region of interest, which may provide more information about the left tail of the distribution of the standardized innovations. Extensive simulation and empirical studies show the ability of the introduced method to outperform standard approaches.

11 Nov
15:50-16:20

Bayesian Inference of the Multi-Period Optimal Portfolio for an Exponential Utility

David Bauder¹, **Taras Bodnar**², Nestor Parolya³, Wolfgang Schmid⁴

¹Humboldt-University of Berlin; ²Stockholm University; ³Delft University of Technology;

⁴European University Viadrina

We consider the estimation of the multi-period optimal portfolio obtained by maximizing an exponential utility. Employing Jeffreys' non-informative prior and the conjugate informative prior, we derive stochastic representations for the optimal portfolio weights at each time point of portfolio reallocation. This provides a direct access not only to the posterior distribution of the portfolio weights but also to their point estimates together with uncertainties and their asymptotic distributions. Furthermore, we present the posterior predictive distribution for the investor's wealth at each time point of the investment period in terms of a stochastic representation for the future wealth realization. This in turn makes it possible to use quantile-based risk measures or to calculate the probability of default. We apply the suggested Bayesian approach to assess the uncertainty in the multi-period optimal portfolio by considering assets from the FTSE 100 in the weeks after the British referendum to leave the European Union. The behaviour of the novel portfolio estimation method in a precarious market situation is illustrated by calculating the predictive wealth, the risk associated with the holding portfolio, and the default probability in each period.

11 Nov
16:20-16:50

Interpreting Big Data in the Macro Economy: A Bayesian Mixed Frequency Estimator

David Kohns¹, Arnab Bhattacharjee²

¹Scottish Graduate Program in Economics and Spatial Economics & Econometrics Centre; ²Spatial Economics & Econometrics Centre

More and more are Big Data sources, such as Google Trends, being used to augment nowcast models. An often neglected issue within the previous literature, which is especially pertinent to policy environments, is the interpretability of the Big Data source included in the model. We provide a Bayesian modeling framework which is able to handle all econometric issues involved in combining Big Data with traditional macroeconomic time series, while remaining computationally simple and

allowing for a high degree of interpretability. In our model, we explicitly account for the possibility that the Big Data and macroeconomic data set included have different degrees of sparsity. We test our methodology by investigating whether Google Trends in real time increase nowcast fit of US real GDP growth compared to traditional macroeconomic time series. We find that search terms improve performance of both point forecast accuracy as well as forecast density calibration not only before official information is released but also later into GDP reference quarters. Our transparent methodology shows that the increased fit stems from search terms acting as early warning signals to large turning points in GDP.

Forecast Encompassing Tests for the Expected Shortfall

Timo Dimitriadis^{1,2}, Julie Schnaitmann³

12 Nov
09:00-09:30

¹Heidelberg Institute for Theoretical Studies; ²University of Hohenheim; ³ University of Konstanz

In this paper, we introduce new forecast encompassing tests for the risk measure Expected Shortfall (ES). Forecasting and forecast evaluation techniques for the ES are rapidly gaining attention through the recently introduced Basel III Accords, which stipulate the use of the ES as primary market risk measure for the international banking regulations. Encompassing tests generally rely on the existence of strictly consistent loss functions for the functionals under consideration, which do not exist for the ES. However, our encompassing tests are based on recently introduced loss functions and an associated regression framework which considers the ES jointly with the corresponding Value at Risk (VaR). This setup facilitates several testing specifications which allow for both, joint tests for the ES and VaR and stand-alone tests for the ES. We present asymptotic theory for our encompassing tests and verify their finite sample properties through various simulation setups. In an empirical application, we utilize the encompassing tests in order to demonstrate the superiority of forecast combination methods for the ES for the IBM stock.

Long-run Predictability Tests are Even Worse than You Thought

Erik Hjalmarsson¹, Tamás Kiss²

12 Nov
09:30-10:00

¹University of Gothenburg; ²Örebro University School of Business

We derive a general scaling result for long-horizon t -statistics for stationary $AR(1)$ predictors, where the (near) unit-root result shows up as a limiting case. The scaled t -statistic together with standard-normal critical values result in a correctly-sized test, as long as the predictor is exogenous. For endogenous predictors, the test is size distorted regardless of the persistence in the predictor. The endogeneity problem stems from the long-run estimation and is distinct from the ordinary persistence-dependent “Stambaugh” bias. The bias for fully stationary predictors appears not to have been previously noted and adds further difficulty to inference in long-run predictive regressions.

12 Nov
10:30-11:00

Sampling Distributions of Optimal Portfolio Weights and Characteristics in Low and Large Dimensions

Taras Bodnar¹, Holger Dette², Nestor Parolya³, Erik Thorsén¹

¹Stockholm University; ²Ruhr University Bochum; ³Delft University of Technology

Optimal portfolio selection problems are determined by the (unknown) parameters of the data generating process. If an investor want to realise the position suggested by the optimal portfolios he/she needs to estimate the unknown parameters and account for the parameter uncertainty introduced into the decision process. Most often, the parameters of interest are the population mean vector and the population covariance matrix of the asset return distribution. In this paper we characterise the exact sampling distribution of the estimated optimal portfolio weights and their characteristics by deriving their sampling distribution which is present in terms of a stochastic representation. This approach possesses several advantages, like (i) it determines the sampling distribution of the estimated optimal portfolio weights by expressions which could be used to draw samples from this distribution efficiently; (ii) the application of the derived stochastic representation provides an easy way to obtain the asymptotic approximation of the sampling distribution. The later property is used to show that the high-dimensional asymptotic distribution of optimal portfolio weights is a multivariate normal and to determine its parameters. Moreover, a consistent estimator of optimal portfolio weights and their characteristics is derived under the high-dimensional settings. Via an extensive simulation study, we investigate the finite-sample performance of the derived asymptotic approximation and study its robustness to the violation of the model assumptions used in the derivation of the theoretical results.

12 Nov
11:00-11:30

Dynamic Black-Litterman Copula-based Optimal Portfolios with Tail Constraints

Maziar Sahamkhadam¹, Andreas Stephan², Ralf Östermark³

¹Linaeus University; ²Jönköping International Business School; ³Åbo Akademi

The original Black-Litterman (BL) approach assumes normality, constant conditional distribution and no tail dependency, neither symmetric nor asymmetric. We estimate returns' conditional distribution from a dynamic BL approach and model the tail dependency by applying truncated regular vine (Rvine) copula. Furthermore, reward-to-risk ratio optimizations generally consider only two portfolio characteristics, expected return and risk. This paper shows that including tail constraints leads to more flexible portfolio strategies, combining tail and classical risk-return optimization techniques. In this paper, Value-at-Risk (VaR) and Conditional Value-at-Risk (CVaR) are used as downside risk measure and added in classical reward-risk optimization. To examine the performance of the suggested forecasting models and optimization techniques, we perform out-of-sample back-testing for several portfolio strategies applied to a dataset consisting of 30 stocks listed on the Stockholm exchange. We compare our results with benchmark portfolios including equally

weighted (EQW) portfolio and portfolios obtained from dynamic BL model without copulas. The results show more flexibility and frequent out-performance for the tail constraint augmented portfolios. In general, the suggested version of BL approach outperforms the benchmark models regarding both portfolio return and risk measures.

Dynamic Modeling of the Global Minimum Variance Portfolio Weights

Fabian Krüger¹, Roman Liesenfeld², **Laura Reh**²

¹Heidelberg University; ²University of Cologne

12 Nov
11:30-12:00

We propose a novel dynamic approach to forecast the weights of the global minimum variance portfolio (GMVP). We exploit the fact that the GMVP weights can be obtained as the population coefficients of a linear regression of one benchmark return on a vector of return differences. This enables us to derive a consistent loss function from which we can infer the optimal GMVP weights without imposing any distributional assumptions on the returns. In order to capture time variation in the assets' conditional covariance structure, we model the portfolio weights through a Recursive Least Squares scheme as well as by Generalized Autoregressive Score type dynamics. Sparse parameterizations ensure scalability with respect to the number of assets. An empirical analysis of daily and monthly financial returns shows that the model performs well in- and out-of-sample in comparison to existing approaches.

The Global Interest Rate Differential and the Dollar Carry Trade

Tommy von Brömsen

Sveriges Riksbank

12 Nov
13:00-13:30

This paper studies the global interest rate differential (GID) - defined as the difference between the highest and the lowest interest rate among the G10 currencies - and documents that changes in GID contain predictive information about future dollar carry trade returns. Specifically, the dollar carry trade is, on average, only profitable after observing a decrease in GID. A novel trading strategy is presented which exploits the predictability and delivers a Sharpe ratio superior to the dollar carry trade, as well as to the standard high-minus-low carry trade, both in- and out-of-sample. These empirical findings can be understood through the lens of a reduced-form, no-arbitrage model. Global shocks cause a systematic increase in the volatility of pricing kernels, which amplifies expected currency returns. This amplification effect sheds crucial light on the profitability of the dollar carry trade and, as a result, on the dynamics of the US dollar itself.

Sparsity in Expected Returns

Daniele Bianchi¹, Matthias Büchner², Andrea Tamoni³

¹Queen Mary University of London; ² University of Warwick; ³Rutgers Business School

We provide a measure of sparsity for expected returns within the context of linear factor models. Our measure is inversely related to the percentage of active predictors. Empirically, sparsity varies over time and displays an apparent countercyclical behavior. Proxies for financial conditions and for liquidity supply are key determinants of the variability in sparsity. Deteriorating financial conditions and illiquid times are associated with an increase in the number of characteristics that are useful to predict anomaly returns (i.e., the forecasting model becomes more dense). Looking at specific categories of characteristics, we find that only trading frictions is robustly present throughout the sample. A substantial amount of the time-variation in sparsity is attributable to the value, profitability, and investment categories. A strategy that exploits the dynamics of sparsity to time factors delivers substantial economic gain out-of-sample relative to both a random walk and a model based on preselected, well-know characteristics like size, momentum and book-to-market.

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