

Preface

This book is our little present for Ole Eiler Barndorff-Nielsen on the occasion of his 80th birthday. The four of us are all still rather young and thus only met Ole for the first time during the last 15 years. For all of us meeting, working and discussing research with Ole has been a wonderful experience. His kindness, his wide scientific interests, his great insights (both mathematically and in actual applications), his eagerness to cooperate with young scientists, and his many other qualities, have been a great gift and inspiration. Looking at his oeuvre one immediately sees that he has worked in many different areas, all usually connected to probability and statistics, and made a deep impact in many of them.

In this Preface we do not attempt in any way to summarise his achievements, neither can this book cover all aspects of Ole's work. But we are very glad that many colleagues with whom Ole collaborated in some way or another agreed to contribute to this book. We hope that the contributions collected here create a fascinating journey through probability, statistics and their applications in relation to Ole and his work. Of course, we could have asked many more colleagues to contribute (and many more would have certainly said yes), but like for many things in life there is a limit for the reasonable size of a book. Likewise, given Ole's current industriousness and continuing interest to investigate new scientific questions, this book will certainly fail to include some areas which Ole will look into in the future. So instead of expounding more inadequate words, we want to let the contributions in this book speak for themselves and in the meantime please join us in wishing:

Tillykke med fødselsdagen, Ole, og vi glæder os til mange flere år i dit inspirerende selskab! Happy Birthday, Ole, and we are looking forward to many more years in your inspiring company!

Let us now give you a little tour guide for your journey through probability, statistics and their applications when reading this book. At first we have a piece on Ole's (scientific) life written by Eva Vedel-Jensen, Mark Podolskij and further collaborators as a "pleasant" starter.

Then we go medias in res in an area which Ole has been excited about for decades—sand and turbulence. There are three papers on this area: Michael Sørensen develops a model for the grain size distribution in a natural sand deposit based on the normal inverse Gaussian distribution, a special case of the generalised hyperbolic distribution; Björn Birnir's article focuses on the closely related question of whether or not one can prove that the turbulence in the wind which shapes natural sand deposits causes a mass distribution which is described well by the generalised hyperbolic distribution; and finally, José Ulises Márquez and Jürgen Schmiegel introduce a new modelling framework for turbulent velocity fields based on the class of so-called Brownian semistationary processes, where again the normal inverse Gaussian distribution features as an important ingredient.

Next, a paper by Gérard Letac reminds us of perhaps the first big topic in Ole's works: Exponential Families. This is followed by another (theoretical) statistics paper written by Per Mykland and Jianming Ye which focuses on cumulants and Bartlett identities in Cox regressions, which is related to Ole's work on accuracy in statistical theory. Two papers, one by Martin Drapatz and Alexander Lindner and one by Peter Tankov, look at the (probability) theory of infinitely divisible distributions—another area to which Ole has contributed throughout the years. While the former paper investigates the concept of exchangeability in the context of infinitely divisible distribution, the latter article gives a comprehensive review of recent results in the area of Lévy copulas.

Thereafter, there are four papers reflecting Ole's various interests in (the theory of) stochastic processes. First, Fred Espen Benth and Asma Khedher consider generalised Ornstein-Uhlenbeck processes, which exhibit stochastic mean-reversion, and investigate weak stationarity of such processes. Next, Jorge Ramirez, Enrique Thomann and Ed Waymire study the continuity of local times with applications in physics and biology. Bohan Chen, Carsten Chong and Claudia Klüppelberg then present numerical methods for simulating stochastic Volterra equations when the driving space-time Lévy noise is of pure jump type. Finally, Victor Pérez-Abreu and Alfonso Rocha-Arteaga study the eigenvalue-process associated to a matrix-valued Lévy process.

In empirical applications, stochastic processes have to be estimated, so Neil Shephard and Justin Yang consider likelihood inference in trawl processes—a model that has previously been introduced in a paper with Ole as one of the authors. This is followed by two papers on time series, one by Thibault Jaisson and Mathieu Rosenbaum, who consider different asymptotic regimes of nearly unstable autoregressive processes, and another one by Alessandra Luati and Tommaso Proietti, who introduce the concept of generalised partial autocorrelations in the context of stationary processes.

Aarhus Institute of Advanced Studies | Aarhus University | Denmark

**AARHUS CONFERENCE ON PROBABILITY, STATISTICS
AND THEIR APPLICATIONS**

15-19 June 2015

**Celebrating the scientific achievements of
Ole E. Barndorff-Nielsen**

Invited Speakers

Søren Asmussen (Aarhus University)
 Andreas Basse-O'Connor (Aarhus University)
 Fred Espen Benth (University of Oslo)
 Jean Bertoin (University of Zürich)
 Bjørn Birnir (University of California Santa Barbara)
 José Manuel Corcuera (University of Barcelona)
 David Cox (University of Oxford)
 Mark Davis (Imperial College London)
 Giulia di Nunno (University of Oslo)
 Peter Reinhard Hansen (European University Institute)
 Friedrich Hubalek (Vienna University of Technology)
 Jean Jacod (UMC Paris VI)
 Eva B. Vedel Jensen (Aarhus University)
 Søren Johansen (University of Copenhagen)
 Andreas Kyprianou (University of Bath)
 Gérard Letac (Université Paul Sabatier, Toulouse)
 Alexander Lindner (Ulm University)
 Alessandra Lualaba (University of Bologna)
 Asger Lunde (Aarhus University)
 Makoto Maejima (Keio University)
 Per Mykland (University of Chicago)
 Mikko Pakkanen (Imperial College London)
 Giovanni Peccati (Luxembourg University)
 Victor Pérez-Abreu (CIMAT, Mexico)
 Victor Rivera (CIMAT, Mexico)
 Mathieu Rosenbaum (UPMC, Paris VI)
 Jan Rosinski (University of Basel)
 Jürgen Schmiegel (Aarhus University)
 Neil Shephard (Harvard University)
 Albert Shiryaev (Steklov Mathematical Institute)
 Michael Sørensen (University of Copenhagen)
 Peter Tankov (Université Paul Sabatier, Paris VII)
 Ed Whymire (Oregon State University)
 Nakahiro Yoshida (University of Tokyo)
 Bernt Øksendal (University of Oslo)

Scope of the Conference

The topics covered at the conference include, but are not limited to, limit theory, stochastic analysis, statistical inference for stochastic processes, mathematical finance and turbulence.

In particular, the conference honors the numerous scientific achievements of Ole E. Barndorff-Nielsen on the occasion of his 80th birthday and some social events will be dedicated to celebrate him.

Deadline for registration: 15 April 2015

Organisers

Mark Podolski (Aarhus University)
 Robert Stelzer (Ulm University)
 Steen Thorbjørnsen (Aarhus University)
 Almut Veraart (Imperial College London)

Please find further information
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oddbjorg@math.au.dk

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Poster announcing the “Aarhus Conference on Probability, Statistics and Their Applications: Celebrating the scientific achievements of Ole E. Barndorff-Nielsen” held in June 2015 © posterdesign and concept by Daniela Mayer, DesignZone, daniela@designzone.info

Especially over the last two decades Ole has enjoyed working on the econometric analysis of high-frequency financial data with a special focus on volatility estimation and inference. So we are pleased that three teams of researchers have decided to contribute their recent research findings in this topic area to this *Festschrift*. First, Jean Jacod and Victor Todorov tackle the problem of efficiently estimating integrated volatility in the presence of jump processes of infinite variation. Next, Masayuki Uchida and Nakahiro Yoshida develop a model selection procedure in the context of a diffusion model which aims for a good prediction of the corresponding spot volatility component. Finally, Peter Reinhard Hansen, Guillaume Horel, Asger Lunde and Ilya Archakov introduce a new estimator for multivariate stochastic volatility within a Markov chain framework.

Volatility reflects risk and the last years have reminded us (the hard way) of the importance of understanding our risks. Therefore, we have Paul Embrechts and Edgars Jakobsons investigating the effects of uncertainty on the dependence structure when quantifying risk, whereas Mark Davis introduces a Beaufort Scale of Predictability (a nice reference back to our first topic—wind—by the way). Next comes a paper by Bernt Øksendal, Agnès Sulem and Tusheng Zhang dealing with a stochastic optimal control problem, before Ole's deep interest in modelling financial markets with Lévy processes is reflected in two papers—one by José Manuel Corcuera, José Fajardo, Wim Schoutens and Arturo Valdivia, who derive pricing formulas for contingent convertible bonds, and one by Giulia Di Nunno and Erik Hove Karlsen, who consider the hedging problem under a worst case scenario when the financial market is driven by time-changed Lévy noises.

Finally, a paper in applied probability by Søren Asmussen (one of Ole's current colleagues in Aarhus), Lester Lipsky and Stephen Thompson, which focuses on restart problems in complex systems and develops suitable Markov renewal methods, rounds off our journey through probability, statistics and their applications.

Given all these contributions it was very hard for us to find an appropriate title for the book, even more as we wanted it to be special, to stick out from the crowd of books and to be related to Ole. In the end it was (once again) Ole that inspired us: This time by the title of his contribution together with Preben Blæsild, Jens Ledet Jensen and Michael Sørensen to the book "A Celebration of Statistics: The ISI Centenary Volume A Volume to Celebrate the Founding of the International Statistical Institute in 1885" edited in 1985 by Anthony C. Atkinson and Stephen E. Fienberg. The title of it was simply "The Fascination of Sand".

We would like to sincerely thank all contributors to this book for their excellent contributions and for their efforts to make this book possible within a short time period. It has been a great pleasure to work with all of you! Likewise, we owe a big thank you to all our anonymous reviewers for their dedication and work which were essential for this book. Last but not least, we wholeheartedly thank Eva Nacca—the good spirit of the Institute of Mathematical Finance in Ulm—for taking care of many details for the book and the Springer staff, in particular Marina Reizakis and Catriona Byrne, for being extremely helpful and making the publication possible.

From 15 to 19 June 2015, the “Aarhus Conference on Probability, Statistics and Their Applications: Celebrating the scientific achievements of Ole E. Barndorff-Nielsen” took place at the University of Aarhus and we presented the first preliminary version of this book to Ole at that conference. It was a pleasure to organise this event. As part of this, we would like to take this opportunity to wholeheartedly thank:

- the (other) local organisers: Søren Asmussen, Andreas Basse-O’Connor, Eva B. Vedel-Jensen, Jens Ledet Jensen, Asger Lunde, Jan Pedersen and Jürgen Schmiegel,
- Oddbjørg Wethelund for her tremendous efforts,
- CREATES, CSGB, the Department of Mathematics and the Faculty of Science and Technology at Aarhus University for their great financial support,
- and the invited speakers for their talks—many of them based on contributions to this volume.

To conclude we hope that when you read the contributions now you enjoy them as much as we did when we edited the book.

Aarhus
Ulm
Aarhus
London
June 2015

Mark Podolskij
Robert Stelzer
Steen Thorbjørnsen
Almut E.D. Veraart

The Fascination of Probability, Statistics and their
Applications

In Honour of Ole E. Barndorff-Nielsen

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