Statistics for Finance

Statistics for Finance develops students’ professional skills in statistics with applications in finance. Developed from the authors’ courses at the Technical University of Denmark and Lund University, the text bridges the gap between classical, rigorous treatments of financial mathematics that rarely connect concepts to data and books on econometrics and time series analysis that do not cover specific problems related to option valuation.

The book discusses applications of financial derivatives pertaining to risk assessment and elimination. The authors cover various statistical and mathematical techniques, including linear and nonlinear time series analysis, stochastic calculus models, stochastic differential equations, Itô’s formula, the Black–Scholes model, the generalized method-of-moments, and the Kalman filter. They explain how these tools are used to price financial derivatives, identify interest rate models, value bonds, estimate parameters, and much more.

This textbook will help students understand and manage empirical research in financial engineering. It includes examples of how the statistical tools can be used to improve value-at-risk calculations and other issues. In addition, end-of-chapter exercises develop students’ financial reasoning skills.

Statistics in Finance

General information
State: Published
Organisations: Mathematical Statistics, Department of Informatics and Mathematical Modeling, Lund University
Authors: Madsen, H. (Intern), Nielsen, J. N. (Intern), Lindström, E. (Ekstern), Baadsgaard, M. (Intern), Holst, J. (Intern)
Number of pages: 300
Publication date: 2004
Estimating Multivariate Exponential-Affine Term Structure Models from Coupon Bound Prices using Nonlinear Filtering

An econometric analysis of continuous-time models of the term structure of interest rates is presented. A panel of coupon bond prices with different maturities is used to estimate the embedded parameters of a continuous-discrete state space model of unobserved state variables: the spot interest rate, the central tendency and stochastic volatility. Emphasis is placed on the particular class of exponential-affine term structure models that permits solving the bond pricing PDE in terms of a system of ODEs. It is assumed that coupon bond prices are contaminated by additive white noise, where the stochastic noise term should account for model errors. A nonlinear filtering method is used to compute estimates of the state variables, and the model parameters are estimated by a quasi-maximum likelihood method provided that some assumptions are imposed on the model residuals. Both Monte Carlo simulation results and empirical results based on the Danish bond market are presented.

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Mathematical Statistics
Authors: Baadsgaard, M. (Intern), Nielsen, J. N. (Intern), Madsen, H. (Intern)
Number of pages: 20
Publication date: 2000

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Nonlinear filtering, Quasi maximum likelihood estimation, State space models, Stochastic differential equations, Stochastic volatility, Term structure modelling
Electronic versions:
Estimating_Multivariate_Exponential_Affine.pdf
Source: orbit
Source-ID: 199895
Publication: Research › Other contribution – Annual report year: 2000

Estimation in continuous-time stochastic volatility models using nonlinear filters


General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Mathematical Statistics
Authors: Nielsen, J. N. (Intern), Vestergaard, M. (Ekstern), Madsen, H. (Intern)
Pages: 279-308
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: International Journal of Theoretical and Applied Finance
Volume: 3
Issue number: 2
ISSN (Print): 0219-0249
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.537 SNIP 0.7 CiteScore 0.58
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.564 SNIP 0.693 CiteScore 0.6
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.786 SNIP 0.891 CiteScore 0.72
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.739 SNIP 0.614 CiteScore 0.62
ISI indexed (2013): ISI indexed no
Parameter Estimation in Stochastic Differential Equations; An Overview
This paper presents an overview of the progress of research on parameter estimation methods for stochastic differential equations (mostly in the sense of Ito calculus) over the period 1981-1999. These are considered both without measurement noise and with measurement noise, where the discretely observed stochastic differential equations are embedded in a continuous-discrete time state space model. Every attempts has been made to include results from other scientific disciplines. Maximum likelihood estimation of parameters in nonlinear stochastic differential equations is in general not possible due to the unavailability of closed form expressions for the transition and stationary probability density functions of the states. However, major developments are classified according to their approximation to the "true" maximum likelihood solution as opposed to a historical order of presentation.

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Mathematical Statistics
Authors: Nielsen, J. N. (Intern), Madsen, H. (Intern), Young, P. C. (Ekstern)
Pages: 83-94
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Annual Reviews in Control
Volume: 24
ISSN (Print): 1367-5788
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.284 SNIP 2.389 CiteScore 3.52
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.086 SNIP 5.012 CiteScore 5.65
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.196 SNIP 3.865 CiteScore 4.63
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.216 SNIP 3.907 CiteScore 3.99
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Utility survey of requirements for a HTS fault current limiter

The application of superconducting fault current limiters (SFCL) in the electric utility sector will clearly depend on to what extent the needs and requirements of electric utilities can be met by the ongoing development of SFCL technology. This paper considers a questionnaire survey of which needs and expectations the Danish electric utilities have to this new technology. A bus-tie application of SFCL in a distribution substation with three parallel-coupled transformers is discussed.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, DEFU a.m.b.a.
Authors: Nielsen, J. N. (Intern), Jørgensen, P. (Ekstern), Østergaard, J. (Intern), Tønnesen, O. (Intern)
Pages: 1001-1004
Publication date: 2000

Host publication information
Title of host publication: Proceedings of 4th European Conference on Applied Superconductivity

Series: Institute of Physics Conference Series
Volume: 167
ISSN: 0951-3248
Main Research Area: Technical/natural sciences
Electronic versions:
1999_Published_Conference_Utility_survey_of_requirements_for_HTS_fault_current_limiter.pdf
Source: orbit
Source-ID: 251803
Publication: Research - peer-review › Article in proceedings – Annual report year: 1999
Estimating parameters in discretely, partially observed stochastic differential equations

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Novo Nordisk A/S
Authors: Nielsen, J. N. (Intern), Madsen, H. (Intern), Melgaard, H. (Ekstern)
Publication date: 1999

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 172878
Publication: Research - peer-review › Report – Annual report year: 1999

Parameter Estimation in Nonlinear Stochastic Differential Equations: An Overview

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Lancaster University
Authors: Nielsen, J. N. (Intern), Madsen, H. (Intern), Young, P. (Ekstern)
Pages: 289-294
Publication date: 1999

Host publication information
Title of host publication: Proceedings of 14th IFAC World Congress - Vol J.
Publisher: Elsevier Science
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 170967
Publication: Research - peer-review › Article in proceedings – Annual report year: 1999

Stochastic modelling of dynamic systems

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Nielsen, J. N. (Intern)
Publication date: 1999

Publication information
Original language: English
Series: IMM-PHD-1999-72
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 200831
Publication: Research › Ph.D. thesis – Annual report year: 1999


General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Madsen, H. (Intern), Nielsen, J. N. (Intern), Nielsen, T. S. (Intern)
Number of pages: 20
Publication date: 1998

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 170412
Publication: Research - peer-review › Report – Annual report year: 1998
Design Values for the CUSUM-MS Chart

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Novo Nordisk A/S
Authors: Madsen, H. (Intern), Iversen, J. (Ekstern), Nielsen, J. N. (Intern), Nielsen, T. S. (Intern)
Number of pages: 8
Publication date: 1998

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 170411
Publication: Research - peer-review › Report – Annual report year: 1998

Estimation in Continuous-Time Stochastic Volatility Models using Nonlinear Filters

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Nielsen, J. N. (Intern), Vestergaard, M. (Ekstern), Madsen, H. (Intern)
Pages: 1-29
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: Int. Journal of Theoretical and Applied Finance
Original language: English
Source: orbit
Source-ID: 171103
Publication: Research - peer-review › Journal article – Annual report year: 1998


General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Novo Nordisk A/S
Authors: Nielsen, J. N. (Intern), Madsen, H. (Intern), Melgaard, H. (Ekstern), Baadsgaard, M. (Intern)
Number of pages: 23
Publication date: 1998

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 172611
Publication: Research - peer-review › Report – Annual report year: 1998


General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Nielsen, J. N. (Intern), Madsen, H. (Intern)
Number of pages: 29
Publication date: 1998

Publication information
Original language: English
Mathematical Finance - An Introduction

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Nielsen, J. N. (Intern)
Number of pages: 15
Publication date: 1998

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 170386
Publication: Research - peer-review › Book – Annual report year: 1998

Nonlinear Filtering of Univariate Stochastic Volatility Models

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Nielsen, J. N. (Intern), Vestergaard, M. (Ekstern), Madsen, H. (Intern)
Pages: 123-128
Publication date: 1998

Host publication information
Title of host publication: Proceedings of the 14th IFAC World Congress - Vol. M
Publisher: Elsevier Science
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 170966
Publication: Research - peer-review › Article in proceedings – Annual report year: 1998

Online data validation: Outlier detection and accommodation

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Nielsen, J. N. (Intern), Madsen, H. (Intern)
Number of pages: 27
Publication date: 1998

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 170405
Publication: Research - peer-review › Report – Annual report year: 1998

Online data validation - Outlier detection and accommodation

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Nielsen, J. N. (Intern)
Number of pages: 30
Publication date: 1998
Stochastic calculus - An Introduction

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Nielsen, J. N. (Intern)
Number of pages: 29
Publication date: 1998

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 172609
Publication: Research - peer-review › Report – Annual report year: 1998

Statistics in Finance

General information
State: Published
Organisations: Mathematical Statistics, Department of Informatics and Mathematical Modeling
Authors: Madsen, H. (Intern), Nielsen, J. N. (Intern), Baadsgaard, M. (Intern)
Number of pages: 336
Publication date: 1998

Publication information
Place of publication: DTU
Publisher: Informatics and Mathematical Modelling, Technical University of Denmark, DTU
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 224565
Publication: Education › Book – Annual report year: 1998

Estimation in Stochastic Differential Equations with a State Dependent Diffusion Term: 11th IFAC Symposium on System Identification, Vol. 3

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Baadsgaard, M. T. (Intern), Nielsen, J. N. (Intern), Spliid, H. (Intern), Madsen, H. (Intern)
Pages: 1425-1430
Publication date: 1997

Host publication information
Title of host publication: 11th IFAC Symposium on System Identification, Vol. 3
Place of publication: Kitakyushu, Fukuoka
Main Research Area: Technical/natural sciences
Conference: 11th IFAC Symposium on System Identification (SYSID’97), Fukuoka, Japan, 07/07/1997 - 07/07/1997
Source: orbit
Source-ID: 168644
Publication: Research - peer-review › Article in proceedings – Annual report year: 1997


General information
Modelling heat dynamics using thermal networks: Chapter 13 in System Identification Competition

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Nielsen, J. N. (Intern), Madsen, H. (Intern)
Publication date: 1996

Host publication information
Title of host publication: System Identification Competition
Place of publication: Ispra, Italy
Publisher: Bloem, J.J., Stampa, Arta
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 165692
Publication: Research › Article in proceedings – Annual report year: 1996

Sampling Techniques in stochastic differential equations: Conference on Mathematical Finance

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Baadsgaard, M. T. (Intern), Nielsen, J. N. (Intern), Madsen, H. (Intern), Preisel, M. (Ekstern)
Publication date: 1996

Host publication information
Title of host publication: Sampling Techniques in stochastic differential equations
Main Research Area: Technical/natural sciences
Conference: Conference on Mathematical Finance, Aarhus, 01/01/1996
Source: orbit
Source-ID: 165678
Publication: Research › Article in proceedings – Annual report year: 1996


General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Nielsen, J. N. (Intern)
Publication date: 1996

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 165693
Publication: Research - peer-review › Report – Annual report year: 1996

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Nielsen, J. N. (Intern)
Publication date: 1996

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 165694
Publication: Research - peer-review › Report – Annual report year: 1996

Projects:

Stochastic modelling of nonlinear systems
Department of Informatics and Mathematical Modeling
Period: 01/03/1996 → 29/03/2001
Number of participants: 4
Phd Student:
Nielsen, Jan Nygaard (Intern)
Main Supervisor:
Madsen, Henrik (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)
Ljung, Lennert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Statistisk finansieringsteori
Liberaliseringen af de internationale finansmarkeder har gjort det nødvendigt for banker og investeringsselskaber mm. at anvende avancerede matematiske og statistiske metoder til risikostyring og -elimination (hedging). Der benyttes ikke-lineære filtreringsmetoder til parameter- og tilstandsestimation i diskret observerede stokastiske differentialligninger. Der anvendes ikke-parametriske metoder til idenfifikaton af stokastiske differentialligninger og heteroskedastiske modeller i diskret tid. Metoderne anvendes til modellering af multivariate rentestrukturmodeller og stokastiske volatilitetsmodeller.

Department of Informatics and Mathematical Modeling
Unibank
Basispoint
Period: 01/01/1994 → …
Number of participants: 3
Project participant:
Nielsen, Jan Nygaard (Intern)
Baadsgaard, Mikkel (Intern)
Project Manager, organisational:
Madsen, Henrik (Intern)
Project