



Course and Examination Fact Sheet: Autumn Semester 2023

10,386: Time Series Methods in Financial Econometrics

ECTS credits: 4

Overview examination/s

(binding regulations see below)

decentral - Oral examination and technical discussions, Analog, Individual work individual grade (70%)

Examination time: Term time

decentral - Written work, Digital, Group work group grade (30%)

Examination time: Term time

Attached courses

Timetable -- Language -- Lecturer

[10,386,1.00 Time Series Methods in Financial Econometrics](#) -- English -- [Gagliardini Patrick](#)

Course information

Course prerequisites

Students who plan to take this course as an *optional* course and *without an examination* should not register via the bidding system. They should register directly with the lecturer.

Students who plan to take this course as a *regular* course or as an *optional* course *with an examination* should register via the bidding system. Enrolment in a course is binding: students have to attend the course and take the exam. The grade will be shown on the scorecard.

Learning objectives

The goal of this course is to introduce students to advanced econometric methods for time series data in financial applications.

Course content

The course focuses on the Generalized Method of Moment (GMM) and nonparametric methods, and considers estimation and inference for asset pricing and derivative pricing models.

The first part of the course is concerned with the GMM. The GMM has been introduced in Hansen (1982) and Hansen, Singleton (1982) to estimate a structural parameter defined by moment restrictions. In economic applications, moment restrictions are typically deduced from the Euler conditions implied by expected utility maximization or, more generally, the no-arbitrage principle. In this course we investigate the implementation and the large sample properties of GMM with serially dependent data. We address the key issues of consistent estimation of the variance-covariance matrix of the GMM estimator and optimal choice of the weighting matrix.

Nonparametric methods are the subject of the second part of the course. Nonparametric methods are appealing for empirical economic analysis since they dispense the researcher from introducing restrictive parametric assumptions, that have no justification in economic or financial theory. The course focuses on the most commonly used nonparametric method in economics, that is the kernel based approach. We consider kernel estimators of density functions, regression functions and their derivatives, with time series data. We investigate the large sample properties of kernel estimators, and we address the issue of the choice of the bandwidth parameter.

There exists an important literature in finance on applications of GMM and nonparametric methods for asset pricing purposes. In the last part of the course we consider GMM estimation of asset pricing models in either preference-based, or no-arbitrage, modeling frameworks. We also review recent applications of nonparametric methods for estimation of risk-neutral densities and



derivative pricing. The literatures on GMM estimation and nonparametric analysis find a point of contact in the so-called information-based approach to GMM. In this area, the course introduces the Extended Method of Moments (XMM), which is a new information-based estimator of option prices using time series data on spot prices and cross-sectional data on derivatives, and the conditional Hansen-Jagannathan distance for comparing possibly misspecified conditional asset pricing models.

Course structure and indications of the learning and teaching design

The outline of the course is the following:

1. GMM with time series data

- i) Mixing processes and mixingales. Law of Large Numbers (LLN) and Central Limit Theorem (CLT) for mixing processes.
- ii) Consistency and asymptotic normality of the GMM estimator with serially dependent data.
- iii) Consistent estimation of the asymptotic variance-covariance matrix.

2. Nonparametric methods

- i) Kernel estimators of density functions and regression functions. Integrals and derivatives of kernel estimators.
- ii) Bias-variance tradeoff. Bandwidth selection rules.
- iii) Large sample properties of kernel estimators.

3. Applications to asset pricing and derivative pricing

- i) GMM estimation of asset pricing models.
- ii) Nonparametric estimation of risk-neutral densities and derivative pricing.
- iii) Information theoretic GMM for estimating and comparing conditional asset pricing models.

Course literature

- [1] Bosq, D. (1998): *Nonparametric Statistics for Stochastic Processes. Estimation and Prediction*, Springer, New-York.
 - [2] Davidson, J. (1994): *Stochastic Limit Theory*, Oxford University Press.
 - [3] Gagliardini, P., Gouriéroux, C., and E., Renault (2011): Efficient Derivative Pricing by the Extended Method of Moments, *Econometrica*, 79, 1181-1232.
 - [4] Gagliardini, P., and D., Ronchetti (2019): Comparing Asset Pricing Models by the Conditional Hansen Jagannathan Distance, forthcoming *Journal of Financial Econometrics*.
 - [5] Gagliardini, P., and D., Ronchetti (2013): Semi-parametric Estimation of American Option Prices, *Journal of Econometrics*, 173, 57-82.
 - [6] Gouriéroux, C., and J., Jasiak (2001): *Financial Econometrics. Problems, Models and Methods*, Princeton University Press.
 - [7] Hall, A. (2005): *The Generalized Method of Moments*, Oxford University Press.
 - [8] Hansen, L. (1982): "Large Sample Properties of Generalized Method of Moments Estimators", *Econometrica*, 50, 1029-1054.
 - [9] Hansen, L., and K., Singleton (1982): "Generalized Instrumental Variable Estimation of Nonlinear Rational Expectations Models", *Econometrica*, 50, 1269-1286.
 - [10] Pagan, A., and A., Ullah (1999): *Nonparametric Econometrics*, Cambridge University Press.
 - [11] Singleton, K. (2006): *Empirical Dynamic Asset Pricing*, Princeton University Press.
 - [12] White, H. (2001): *Asymptotic Theory for Econometricians*, Revised Edition, Academic Press.
- Selected research articles will be discussed in the lectures.

Additional course information

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Examination information

Examination sub part/s



1. Examination sub part (1/2)

Examination modalities

Examination type	Oral examination and technical discussions
Responsible for organisation	decentral
Examination form	Oral examination
Examination mode	Analog
Time of examination	Term time
Examination execution	Asynchronous
Examination location	On Campus
Grading type	Individual work individual grade
Weighting	70%
Duration	--

Examination languages

Question language: English
Answer language: English

Remark

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Examination-aid rule

Closed Book

The use of aids is prohibited as a matter of principle, with the exception of pocket calculator models of the Texas Instruments TI-30 series and, in case of non-language exams, bilingual dictionaries without any handwritten notes. Any other aids that are admissible must be explicitly listed by faculty members in the paragraph entitled "Supplementary aids" of the course and examination fact sheet; this list is exhaustive.

Procuring any aids, as well as ensuring their working order, is the exclusive responsibility of students.

Supplementary aids

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2. Examination sub part (2/2)

Examination modalities

Examination type	Written work
Responsible for organisation	decentral
Examination form	Written work
Examination mode	Digital
Time of examination	Term time
Examination execution	Asynchronous
Examination location	Off Campus
Grading type	Group work group grade
Weighting	30%
Duration	--

Examination languages

Question language: English
Answer language: English

Remark

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Examination-aid rule



Free aids provision

Basically, students are free to choose aids. Any restrictions are defined by the faculty members in charge of the examination under supplementary aids.

Supplementary aids

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Examination content

Whole material discussed in class and related literature.

Examination relevant literature

Whole material discussed in class and related literature.

Please note

Please note that only this fact sheet and the examination schedule published at the time of bidding are binding and takes precedence over other information, such as information on StudyNet (Canvas), on lecturers' websites and information in lectures etc.

Any references and links to third-party content within the fact sheet are only of a supplementary, informative nature and lie outside the area of responsibility of the University of St.Gallen.

Documents and materials are only relevant for central examinations if they are available by the end of the lecture period (CW51) at the latest. In the case of centrally organised mid-term examinations, the documents and materials up to CW 42 are relevant for testing.

Binding nature of the fact sheets:

- Course information as well as examination date (organised centrally/decentrally) and form of examination: from bidding start in CW 34 (Thursday, 24 August 2023);
- Examination information (supplementary aids, examination contents, examination literature) for decentralised examinations: in CW 42 (Monday, 16 October 2023);
- Examination information (supplementary aids, examination contents, examination literature) for centrally organised mid-term examinations: in CW 45 (Monday, 06 November 2023);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised examinations: two weeks before the end of the de-registration period in CW 45 (Monday, 06 November 2023).