



## Course and Examination Fact Sheet: Autumn Semester 2019

### 10,386: Time Series Methods in Financial Econometrics

ECTS credits: 4

#### Overview examination/s

(binding regulations see below)

Decentral - Oral examination (individual) (70%)

Decentral - Group examination paper (all given the same grades) (30%)

#### Attached courses

Timetable -- Language -- Lecturer

[10,386,1.00 Time Series Methods in Financial Econometrics](#) -- Englisch -- [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.

##### Course content

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

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

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 time and form

Decentral - Oral examination (individual) (70%)



## Remark

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## Examination-aid rule

Extended Closed Book

The use of aids is limited; any additional aids permitted are exhaustively listed under "Supplementary aids". Basically, the following is applicable:

- At such examinations, all the pocket calculators of the Texas Instruments TI-30 series and mono- or bilingual dictionaries (no subject-specific dictionaries) without hand-written notes are admissible. Any other pocket calculator models and any electronic dictionaries are inadmissible.
- In addition, any type of communication, as well as any electronic devices that can be programmed and are capable of communication such as notebooks, tablets, PDAs, mobile telephones and others, are inadmissible.
- Students are themselves responsible for the procurement of examination aids.

## Supplementary aids

No aid during the exam.

## Examination languages

Question language: English

Answer language: English

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## 2. Examination sub part (2/2)

### Examination time and form

Decentral - Group examination paper (all given the same grades) (30%)

## Remark

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## Examination-aid rule

Term papers

- Term papers must be written without anyone else's help and in accordance with the known quotation standards, and they must contain a declaration of authorship.
- The documentation of sources (quotations, bibliography) has to be done throughout and consistently in accordance with the APA or MLA standards. The indications of the sources of information taken over verbatim or in paraphrase (quotations) must be integrated into the text in accordance with the precepts of the applicable quotation standard, while informative and bibliographical notes must be added as footnotes (recommendations and standards can be found, for example, in METZGER, C. (2017), Lern- und Arbeitsstrategien (12th ed., Cornelsen Schweiz).
- For any work written at the HSG, the indication of the page numbers both according to the MLA and the APA standard is never optional.
- Where there are no page numbers in sources, precise references must be provided in a different way: titles of chapters or sections, section numbers, acts, scenes, verses, etc.
- For papers in law, the legal standard is recommended (by way of example, cf. FORSTMOSER, P., OGOREK R. et SCHINDLER B. (2018, Juristisches Arbeiten: Eine Anleitung für Studierende (6. Auflage), Zürich: Schulthess, or the recommendations of the Law School).

## Supplementary aids

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## Examination languages

Question language: English

Answer language: English

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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 this fact sheet alone is binding and has priority over any other information such as StudyNet (Canvas), personal databases or faculty members' websites and information provided in their lectures, etc.

Any possible references and links within the fact sheet to information provided by third parties are merely supplementary and informative in nature and are outside the University of St.Gallen's scope of responsibility and guarantee.

Documents and materials that have been submitted no later than the end of term time (CW51) are relevant to central examinations.

Binding nature of the fact sheet:

- Information about courses and examination time (central/decentral) and examination type starting from the beginning of the bidding on 22 August 2019
- Information about examinations (examination aid regulations, examination content, examination-relevant literature) for decentral examinations after the 4th semester week on 14 October 2019
- Information about examinations (examination aid regulations, examination content, examination-relevant literature) for central examinations as from the starting date for examination registration on 4 November 2019

Please consult the fact sheet again after these deadlines have expired.