



Course and Examination Fact Sheet: Autumn Semester 2020

10,386: Time Series Methods in Financial Econometrics

ECTS credits: 4

Overview examination/s

(binding regulations see below)

Decentral - Oral examination (individual) (70%)

Examination time: term time

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

Examination time: term time

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.

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

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

In the case of the President's Board having to implement new directives due to the SARS-CoV-2 pandemic in AS2020, the course information listed above will be changed as follows:

- The course is conducted online via Zoom;
- The recordings of the course are available for 30 days;
- The lecturer informs via e-mail on the changed implementation modalities of the course;
- There are no changes necessary to the course information.

The examination information listed below would be changed as follows:



- The presentations and the oral examinations are conducted online and are being recorded;
- There are no changes necessary to the examination information.

Examination information

Examination sub part/s

1. Examination sub part (1/2)

Examination time and form

Decentral - Oral examination (individual) (70%)

Examination time: term time

Remark

--

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, 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

2. Examination sub part (2/2)

Examination time and form

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

Examination time: term time

Remark

--

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 which is a published template in StudentWeb.

The documentation of sources (quotations, bibliography) has to be done throughout and consistently in accordance with the chosen citation standard such as APA or MLA.

For papers in law, the legal standard is recommended (by way of example, cf. FORSTMOSER, P., OGOREK R. et SCHINDLER B., Juristisches Arbeiten: Eine Anleitung für Studierende, newest edition respectively, or according to the recommendations of the Law School).

The indications of the sources of information taken over verbatim or in paraphrase (quotations) must be integrated into texts 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., Lern- und Arbeitsstrategien, newest edition respectively.

For any work written at the HSG, the indication of the page numbers is mandatory independent of the chosen citation standard. 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.

Supplementary aids

--

Examination languages

Question language: English

Answer language: English

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, 20 August 2020);
- Examination information (regulations on aids, examination contents, examination literature) for decentralised examinations: in CW 42 (Monday, 12 October 2020);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised mid-term examinations: in CW 42 (Monday, 12 October 2020);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised examinations: two weeks before the end of the registration period in CW 44 (Thursday, 29 October 2020).