



Course and Examination Fact Sheet: Spring Semester 2022

10,276: Regression Analysis for Spatial Data

ECTS credits: 4

Overview examination/s

(binding regulations see below)

Decentral - examination paper written at home (individual) (100%)

Examination time: term time

Attached courses

Timetable -- Language -- Lecturer

[10,276,1.00 \(GSERM\) Regression Analysis for Spatial Data](#) -- Englisch -- [Adams Zeno](#) , [Füss Roland](#)

Course information

Course prerequisites

Students should be interested in spatial topics such as real estate markets, urban economics, crime, pollution, spatial distribution of political preferences, and trade flows. We assume that students are familiar with matrix algebra, and have had courses in probability theory and econometrics. The course emphasizes programming and empirical application. The empirical implementation of spatial models is done in R, hence some familiarity in R is useful but not required for the course. The course is open to students from the GPEF and other external PhD programs.

Learning objectives

The goal of this course is to provide students with the main tools for analyzing and visualizing spatial data. Students will learn how to estimate and interpret a range of spatial models and how to program own models in R.

Course content

This course focuses on the visualization and modeling of spatial data. Examples are taken from different research areas such as political science, empirical international trade, criminology, and real estate. It offers a detailed explanation of individual estimation methods and their implementation in R. In this course, students will learn

- How to generate a variety of different maps that visualize the location of spatial units
- How maximum likelihood estimation works and how to set up and optimize a likelihood function in R
- How to deal with computational problems that are frequently accounted when working with spatial data
- How to increase computation speed using concentrated maximum likelihood and the matrix exponential spatial specification model
- How to estimate a spatial regression model both, with cross-sectional and with time-series data
- How to properly interpret the output from a spatial regression model and how to investigate policy interventions.
- A basic background on spatial interaction models, heterogeneous coefficient SAR models, and spatio-temporal models

What students do NOT learn in this course:

- Estimation of spatial regression models with other estimation techniques such as IV, NLS, and Bayesian Methods
- The use of a specialized Geographic Information System such as ArcGIS



Course structure and indications of the learning and teaching design

Monday:

Lecture 1: 09:15 - 12:00

R Tutorial 1: 13:00 - 15:00

Tuesday:

Lecture 2: 09:15 - 12:00

R Tutorial 2: 13:00 - 15:00

Wednesday:

Lecture 3: 09:15 - 12:00

R Tutorial 3: 13:00 - 15:00

Thursday:

Lecture 4: 09:15 - 12:00

R Tutorial 4: 13:00 - 15:00

Friday:

Lecture 5: 09:15 - 12:00

R Tutorial 5: 13:00 - 15:00

Times and room information in the timetable apply.

Course literature

Mandatory:

LeSage, J., and R.K. Pace (2009), "Introduction to Spatial Econometrics". CRC Press.

Supplementary / voluntary:

Elhorst, J.P. (2014), "Spatial Econometrics: From Cross-Sectional Data to Spatial Panels", Springer.

Holly, S., M.H. Pesaran, and T. Yamagata (2011), "The Spatial and Temporal Diffusion of House Prices in the UK", *Journal of Urban Economics* 69, 2-23.

LeSage, J. (2014), "What Regional Scientists Need to Know about Spatial Econometrics", *The Review of Regional Studies* 44, 13-32.

Additional course information

Only for PhD students of the University of St.Gallen:

PiF students may register via regular bidding for the courses offered together by PiF and Global School in Empirical Research Methods (GSERM).

All other PhD students should register for the courses offered by Global School in Empirical Research Methods (GSERM), **both via**



bidding and via GSERM.

In the case of the President's Board having to implement new directives due to the SARS-CoV-2 pandemic in Spring Semester 2022, the course information listed above will be changed as follows:

- The course is conducted online via zoom.
- The recordings of the course are permanently available.
- The written examination is conducted online and is being monitored.
- The lecturer informs the students concerning the changed implementation modalities of the course.

Examination information

Examination sub part/s

1. Examination sub part (1/1)

Examination time and form

Decentral - examination paper written at home (individual) (100%)

Examination time: term time

Remark

Paper Replication or own research idea

Examination-aid rule

Term papers

Written work must be written without outside help according to the known citation standards, and a declaration of authorship must be attached, which is available as a template on the StudentWeb.

Documentation (quotations, bibliography, etc.) must be carried out universally and consistently according to the requirements of the chosen/specified citation standard such as e.g. APA or MLA.

The legal standard is recommended for legal work (cf. by way of example: FORSTMOSER, P., OGOREK R., SCHINDLER B., Juristisches Arbeiten: Eine Anleitung für Studierende (the latest edition in each case), or according to the recommendations of the Law School).

The reference sources of information (paraphrases, quotations, etc.) that has been taken over literally or in the sense of the original text must be integrated into the text in accordance with the requirements of the citation standard used. Informative and bibliographical notes must be included as footnotes (recommendations and standards e.g. in METZGER, C., Lern- und Arbeitsstrategien (latest edition)).

For all written work at the University of St.Gallen, the indication of page numbers is mandatory, regardless of the standard chosen. Where page numbers are missing in sources, the precise designation must be made differently: chapter or section title, section number, article, etc.

Supplementary aids

Examination languages

Question language: English

Answer language: English

Examination content

- SAR model, SDM model, CML, MESS, Spatial Interaction model, Spatial Panel model, HSAR model

Implementing maximum likelihood estimation in R: Full Maximum Likelihood, Concentrated Maximum Likelihood, Matrix Exponential Spatial Specification.



Examination relevant literature

- LeSage, J., and R.K. Pace (2009), "Introduction to Spatial Econometrics". CRC Press, Chapter 1, 2, 3, 4, 8, and 9. LeSage, J., and Y.-Y. Chih (2016), "Interpreting Heterogeneous Coefficient Spatial Autoregressive Panel Models", Economics Letters 142, 1-5.

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 (CW21) at the latest. In the case of centrally organised mid-term examinations, the documents and materials up to CW 12 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 04 (Thursday, 27 January 2022);
- Examination information (regulations on aids, examination contents, examination literature) for decentralised examinations: in CW 12 (Monday, 21 March 2022);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised mid-term examinations: in CW 12 (Monday, 21 March 2022);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised examinations: two weeks before the end of the registration period in CW 15 (Monday, 11 April 2022).