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2L Spatial Econometrics

Essex Summer School in Social Science Data Analysis 2024

Instructors

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Time, Location & Zoom info

Class is from 10:00–13:30 (BST) London time. We will have ample breaks.

The class room is EBS 2.65

Zoom info:
`https://essex-university.zoom.us/j/93710745771?pwd=cE11DecMEMrUuCVxGDirEVpB7W0ZvS.1`

Meeting ID: 937 1074 5771
Password: 477431

Course Content

Spatial dependencies are a universal feature in the social sciences. Phenomena as diverse as the occurrence and outcomes of violent mass protests, policy learning and position taking in party competition, or the competitive setting of tax rates to attract foreign direct investment across neighboring jurisdictions, all share a similar feature: actions taken by one actor are shaped in a theoretically meaningful way by the actions of one or more other actors. Spatial econometrics allows us to detect, model and estimate such interdependencies, and to work towards a causal interpretation of such relationships. The theoretical substance lies in the nature of interconnectedness between units, which can be geographic, economic, cultural, strategic etc., thus covering a wide ground of social science applications. This course begins with a data-oriented view of spatial patterns and dependencies in the data, then introduces a theory guided approach to building, estimating, and evaluating spatial and spatiotemporal regression models, and ends with a critical evaluation of the spatial approaches in the context of causal analysis.

Course Objectives

The course starts from the premise that interconnectedness is an important and theoretically meaningful feature of a broad range of phenomena in the social sciences. The main aim is therefore to enable students to identify and incorporate interconnected features in the study of their own data and areas of interest. This will involve learning how to detect spatial patterns, bringing data into a suitable format for spatial analysis, the estimation of structural parameters of spatial and spatiotemporal models and the presentation of effects. The materials provided in the labs will enable the students to undertake their own applied spatial project.

Course Prerequisites

All necessary background materials will be covered (in brief), though students will benefit most from the course if they have some understanding of regression analysis and a basic knowledge of matrix algebra and maximum likelihood, as well some familiarity with R.

Course Outline

Useful textbooks:

- Michael D. Ward and Kristian Skrede Gleditsch. *Spatial regression models: Second edition*, volume 155. Sage Publications, 2018.

- James P. LeSage and R. Kelley Pace. *Introduction to Spatial Econometrics*. Chapman & Hall/CRC, Boca Raton, 2009 (available as pdf on Box).

Helpful math texts:

- Stephen Boyd. *A primer on matrices*. 2007.
  `https://see.stanford.edu/materials/lsoeldsee263/Additional1-notes-matrix-primer.pdf`

- Stephen G. Pollock. *The Method of maximum likelihood*.
  `https://www.le.ac.uk/users/dsgp1/COURSES/THIRDMET/MYLECTURES/1XMAXILIKE.pdf`

Day 1, 22 July, Theoretical and empirical models of spatial interdependence

Readings:

- LeSage & Pace, chap. 1.

- Ward & Gleditsch, chap. 1.1. – 1.4.
  Applied Example:

- Martin C. Steinwand. Compete or coordinate? aid fragmentation and lead donorship. *International Organization*, 69(2):443–472, 2015.

Day 2, 23 July, Connectivity weights

Readings:

- Nathaniel Beck, Kristian Skrede Gleditsch, and Kyle Beardsley. Space is more than geography: Using spatial econometrics in the study of political economy. *International Studies Quarterly*, 50:27–44, 2006.

- Thomas Plümper and Eric Neumayer. Model specification in the analysis of spatial dependence. *European Journal of Political Research*, 49(3):418–442, 2010.

- Yuri M Zhukov and Brandon M Stewart. Choosing your neighbors: Networks of diffusion in international relations. *International Studies Quarterly*, 57(2):271–287, 2013.

  Applied examples:

- James C. Murdoch, Todd Sandler, and Keith Sargent. A tale of two collectives: Sulphur versus nitrogen oxides emisssion reduction in europe. *Economica*, 64(254):281–301, 1997.

- Martin C. Steinwand. Estimating free-riding behavior: The stratam model. *Political Analysis*, 19(4):488–502, 2011.

Day 3, 24 July, Detecting spatial association & specification checks

Readings:

- Ward & Gleditsch, chap 1.6.

- Luc Anselin. Local indicators of spatial association?lisa. *Geographical analysis*, 27(2):93–115, 1995.

  Applied example:

- Kristian S Gleditsch and Michael D Ward. War and peace in space and time: The role of democratization. *International Studies Quarterly*, 44(1):1–29, 2000.

  Further readings:

- Luc Anselin, Anil K Bera, Raymond Florax, and Mann J Yoon. Simple diagnostic tests for spatial dependence. *Regional science and urban economics*, 26(1):77–104, 1996.

- LeSage & Pace, chap. 6.3.

Day 4, 25 July, Model choice

Readings:

- Scott J. Cook, Jude C. Hays, and Robert Franzese. Model specification and spatial interdependence. In Luigi Curini and Robert Franzese, editors, *The SAGE Handbook of Research Methods in Political Science and International Relations*, pages 730–747. SAGE Publications Ltd, 2020.

- Solmaria Halleck Vega and J Paul Elhorst. The slx model. *Journal of Regional Science*, 55(3):339–363, 2015.

  Applied examples:

- Denise Laroze, Eric Neumayer, and Thomas Plümper. Covid-19 does not stop at open borders: Spatial contagion among local authority districts during england's first wave. *Social Science & Medicine*, 270:113655, 2021.

- Hari Sharma and John Gibson. Civil war and international migration from nepal: Evidence from a spatial durbin model. University of Waikato Working Paper in Economics 6/19, 2019.

- Francisco Villamil, Stuart J Turnbull-Dugarte, and José Rama. Rally?round the barrack: Far-right support and the military. OSF Pre-print, `https://osf.io/nsbt3`, 2021.

Day 6, 28 July, Estimation

Readings:

- Roger Bivand and Gianfranco Piras. Comparing implementations of estimation methods for spatial econometrics. *Journal of Statistical Software*, 63:1–36, 2015.

- Harry H Kelejian and Ingmar R Prucha. A generalized spatial two-stage least squares procedure for estimating a spatial autoregressive model with autoregressive disturbances. *The Journal of Real Estate Finance and Economics*, 17(1):99–121, 1998.

- George Casella and Edward I George. Explaining the gibbs sampler. *The American Statistician*, 46(3):167–174, 1992.

Days 6, 29 July, Effects

Readings:

- LeSage & Pace, chap. 2.7.

- Guy D Whitten, Laron K Williams, and Cameron Wimpy. Interpretation: the final spatial frontier. *Political Science Research and Methods*, 9(1):140–156, 2021

- André Braz Golgher and Paul R Voss. How to interpret the coefficients of spatial models: Spillovers, direct and indirect effects. *Spatial Demography*, 4(3):175–205, 2016.

Further Readings:

- For parametric bootstrap: Gary King, Michael Tomz, and Jason Wittenberg. Making the most of statistical analysis: Improving interpretation and presentation. *American Journal of Political Science*, 44(2):341–355, 2000.

Days 7 & 8, 30 and 31 July, Time & space

Readings:

- Luc Anselin. Spatial econometrics. In Badi H Baltagi, editor, *A companion to theoratical econometrics*, pages 310–330. Blackwell Publishing Ltd, 2003, section 3.2.

- J. Paul Elhorst. Spatial panel data models. In Manfred M. Fischer and Arthur Getis, editors, *Handbook of Applied Spatial Analysis: Software Tools, Methods and Applications*, pages 377–407. Springer Berlin Heidelberg, Berlin, Heidelberg, 2010.

- Giovanni Millo and Gianfranco Piras. splm: Spatial panel data models in r. *Journal of statistical software*, 47:1–38, 2012.

    Applied examples:

- Uwaoma G Nwaogu and Michael J Ryan. Fdi, foreign aid, remittance and economic growth in developing countries. *Review of Development Economics*, 19(1):100–115, 2015.

- Karl Skogstad. Defence budgets in the post-cold war era: a spatial econometrics approach. *Defence and peace economics*, 27(3):323–352, 2016.

- Zhicheng Xu, Yu Zhang, and Yang Sun. Will foreign aid foster economic development? grid panel data evidence from china's aid to africa. *Emerging Markets Finance and Trade*, 56(14):3383–3404, 2020.

Further Readings:

- Scott J Cook, Jude C Hays, and Robert J Franzese. Stadl up! the spatiotemporal autoregressive distributed lag model for tscs data analysis. *American Political Science Review*, pages 1–21. DOI: `https://doi.org/10.1017/S0003055422000272`.

- Jude C Hays, Aya Kachi, and Robert J Franzese. A spatial model incorporating dynamic, endogenous network interdependence: A political science application. *Statistical Methodology*, 7(3):406–428, 2010.

- Wei Wang and Jihai Yu. Estimation of spatial panel data models with time varying spatial weights matrices. *Economics Letters*, 128:95–99, 2015.

Day 9, 1 August, Limited dependent variables & Duration models

Readings:
Spatial probit:

- Kurt J. Beron and Wim P. M. Vijverberg. Probit in a spatial context: A monte carlo analysis. In Luc Anselin, Raymond J. G. M. Florax, and Sergio J. Rey, editors, *Advances in Spatial Econometrics: Methodology, Tools and Applications*, pages 169–195. Springer Berlin Heidelberg, Berlin, Heidelberg, 2004.

- LeSage & Pace., chap. 10.1.

- Robert J Franzese, Jude C Hays, and Scott J Cook. Spatial-and spatiotemporal-autoregressive probit models of interdependent binary outcomes. *Political Science Research and Methods*, 4(1):151–173, 2016.

  Applied example:

- Alexandra Hennessy and Martin C. Steinwand. The sources of pension reforms in europe: Domestic factors, policy diffusion, or common shock? *International Interactions*, 40(4):477–505, 2014.

  Duration models:

- Jude C Hays and Aya Kachi. Interdependent duration models in political science. Presented at APSA 2009, Toronto., 2009.

- Jude C Hays, Emily U Schilling, and Frederick J Boehmke. Accounting for right censoring in interdependent duration analysis. *Political Analysis*, 23(3):400–414, 2015.

  Applied example:

- Nils W Metternich and Julian Wucherpfennig. Strategic rebels: a spatial econometric approach to rebel fighting durations in civil wars. *International Interactions*, 46(3):334–371, 2020.

Further reading:

- Davide Martinetti and Ghislain Geniaux. Approximate likelihood estimation of spatial probit models. *Regional Science and Urban Economics*, 64:30–45, 2017.

Day 10, 4 August, The research frontier

Possible topic: Causality

- Stephen Gibbons and Henry G Overman. Mostly pointless spatial econometrics? *Journal of Regional Science*, 52(2):172–191, 2012.

- Marynia Kolak and Luc Anselin. A spatial perspective on the econometrics of program evaluation. *International Regional Science Review*, 43(1-2):128–153, 2020.

- Kosuke Imai, Zhichao Jiang, and Anup Malani. Causal inference with interference and noncompliance in two-stage randomized experiments. *Journal of the American Statistical Association*, 116(534):632–644, 2021.