SSCI 574 (35777D and 35786D) Spatial Econometrics

Syllabus

Units: 4

Term Day Time: Spring 2024 – Mondays 9 a.m. – 10:50 a.m. and Wednesdays 9 a.m. – 10:50 a.m.

Location: AHF 145A & DEN@Dornsife

Instructor: An-Min Wu, PhD
Office: AHF B55B
Office Hours: Mondays 4 - 5 p.m. and Wednesdays 3 – 4 p.m. in-person or via zoom – please contact me via email in advance to ensure I will be available in the format you'd wish to meet. Also available most days between 9 a.m. – 5 p.m. by appointment.
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Course Scope and Purpose

This course explores theoretical foundations, methods, techniques, and software systems for spatial econometrics. The course aims to provide students with the knowledge and skills necessary to investigate socioeconomic problems, with the consideration of the effects of spatial dependence and spatial heterogeneity. Essential concepts of spatial econometrics are presented, including the fundamental spatial concepts, spatial autocorrelation, and the core components of regression and spatial regression models for both cross-sectional and panel data. The latest research in a variety of topics using spatial econometric models is also examined. Students will gain an in-depth understanding and hands-on experience to explore a variety of applications through a combination of lectures, discussions, presentations, and projects. Students will learn about the variety of geospatial data and techniques available for solving socioeconomic challenges and problems.

This course serves as a required course for the Spatial Economics and Data Analysis M.S. Program and an elective course in the Geographic Information Science and Technology M.S. and Graduate Certificate Programs. Anyone wishing to pursue a career using spatial and economic principles and methods to address environmental challenges in cities, agricultural and natural environments should gain an understanding of spatial statistics and spatial regression and therefore will benefit from this course.

Learning Outcomes

When you have completed this course, you will be able to:
- Articulate the key theoretical concepts of spatial econometrics and how spatial concepts can be used to produce new and better inferences in economics
- Describe the roles played by spatial dependence and spatial heterogeneity in identifying economic opportunities and solving social and environmental problems.
- Analyze cross-sectional data using spatial regression methods in the GeoDa and R software environments.
- Enhance written and oral communication skills that are essential for today's workforce.

Prerequisite(s): None, but some background of statistics and spatial analysis are strongly recommended.
Co-Requisite(s): None
Recommended Preparation(s): SSCI 583 or equivalent.

Class Conduct

Harassment, sexual misconduct, interpersonal violence, and stalking are not tolerated by the university. All faculty and most staff are considered Responsible Employees by the university and must forward all information they receive about these types of situations to the Title IX Coordinator. The Title IX Coordinator is responsible for assisting students with supportive accommodations, including academic accommodations, as well as investigating these incidents

if the reporting student wants an investigation. The Title IX office is also responsible for coordinating supportive measures for transgender and nonbinary students such as faculty notifications, and more. If you need supportive accommodations, you may contact the Title IX Coordinator directly (titleix@usc.edu or 213-821-8298) without sharing any personal information with me. If you would like to speak with a confidential counselor, Relationship and Sexual Violence Prevention Services (RSVP) provides 24/7 confidential support for students (213-740-9355 (WELL); press 0 after hours)

Generative AI Tools such as ChatGPT, DALL-E, Bard and others are now part of the cultural landscape. As in your professional lives, there will be times when using these tools is appropriate and others when there is more benefit to not using them. We will work together to determine the opportunities and responsibilities of using these tools. Some guideline principles in this course include:

- All work should be original and created specifically for the given assignment. You are responsible for the accuracy and originality of any material submitted.
- You should be the authors of all text submitted. In assignments that are collaborative in nature, that group of students will be the co-authors and have all associated responsibilities.
- Academic integrity policies regarding the use of generative AI tools will apply to every assignment.
- The extent to which using a generative AI tool is appropriate will be identified for each assignment. Please note that such use will differ for each assignment.
- Any generative AI text should be treated as source material and should be appropriately cited. In other words, if someone else (or something else) wrote the text, a citation is necessary. You will be asked to further cite not just the source, but how you used these tools. This extra step is reflective of future professional standards and responsibilities.
- Any generative AI image or graphic should be appropriately cited.

Diversity and Inclusion – It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful to everyone, and you are also expected to respect others regardless of their race, ethnicity, gender identity and expressions, cultural beliefs, religion, sexual orientation, national origin, age, abilities, ideas and perspectives, or socioeconomic status. Your suggestions are encouraged and appreciated. Feel free to let me know ways to improve the effectiveness of the course for you personally or for other students.

Course Structure

This is a four-credit course that meets twice per week. The course will be delivered using multiple methods, including in-class lectures, class presentations, discussion and instructor-guided hands-on practice during class meetings. Class meetings are simultaneously conducted in-person and online through WebEx. All course materials and links are available through the

D2L platform. If you cannot join the class meetings synchronously, watching the class recording videos within the same week is mandatory. Exercises utilize unpublished and published materials using ArcGIS Pro, GeoDa, and R, with a focus in R; project-based homework assignments allow students to demonstrate their ability to apply spatial statistical and econometric methods in an appropriate, informed manner. Besides textbooks, additional readings will be assigned to expand on the knowledge background for class discussions. Student participation is encouraged through reading and research discussions, hands-on practices, homework assignments, and class presentations.

This is a graduate-level course, so you should expect this class to be intellectually challenging. As this is a four-credit course, students should expect to spend 10-12 hours per week completing the work in this course. You are expected to engage with the information you are learning and to explore the ideas, opinion, and analysis that describe our collective effort to thoroughly interrogate the subject at hand. Learning arises from active engagement with the knowledge found in our reading materials and with one another. As in any graduate class, the instructor's role is that of a guide who keeps you on this path of discovery.

Course Content Distribution and Synchronous Session Recordings Policies

USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.
Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. (Living our Unifying Values: The USC Student Handbook, page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposed other than individual or group study is prohibited. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which has been distributed to students or in any way has been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. (Living our Unifying Values: The USC Student Handbook, page 13).

Technological and Communication Requirements

The course will be focused on using R as well as GeoDa for course assignments and hands-on practice in class. Both R and GeoDa are free, open-source software. The practice in class will use R and RStudio (an integrated development environment for R), and therefore the installation of the software in your computer (PC or Mac) is preferred. All of these software platforms can also be accessed via VMWare client on the remote SSI.

For online access to SSI Server, every student must have a computer with a fast Internet connection. If you sign up for synchronous, online session (DEN), you also need to have a functional webcam and a microphone for use during the class sessions. If a student does not have access to any of these, please speak with the instructor at the start of the semester to establish a workaround. Also, see the USC ITS Student Toolkit here: https://keepteaching.usc.edu/students/student-toolkit/

SSI Server and Tech Support – If you are unable to connect to the server or experience any type of technical issues, send an email using your USC account to SSI Tech Support at spatial_support@usc.edu, making sure to copy (cc) me on the email. Questions pertaining to specific assignments should be directed to your instructor.

Desire2Learn (D2L) – This course will utilize the Desire2Learn (D2L) learning management system which allows students to access course content, upload assignments, participate in discussion forms, among other learning experiences. The D2L platform provides flexibility in the learning experience where students can participate in the course residentially or remotely, synchronously (meeting together at the same time) or asynchronously (accessing videos and course content outside of class).

Communications – All assignments given and all materials to be handed in will be submitted via D2L. The instructor will also create and monitor discussion forums through which students can discuss issues and assignments as needed. Students should read all email sent from D2L or from course instructor(s) as soon as possible. Also, students who do not regularly use their USC email accounts should double-check to be sure that mail sent from both the D2L accounts and the instructor's account (noted above) to your USC account is forwarded to an address used regularly and does not go into junk mail. The instructor will endeavor to respond to all email within 24 hours of receipt, aiming for no more than 72 hours delay. In the rare case that an instructor is off-line for an extended period of time, an announcement will be posted to the class D2L site. Due to the synchronous and asynchronous nature of this course, it is each student's responsibility to stay informed and connected with others in our course. In addition to email, students are expected to login to D2L regularly to check for announcements.

Required Readings and Supplementary Materials

The required textbook for this course is:

- Chi, G., and J. Zhu. 2019. *Spatial Regression Models for the Social Sciences.* Thousand Oaks, CA: SAGE Publications. (The online version was published in 2021 and is available via USC Libraries).

Supplementary readings will be assigned from various sources including:

- Angrist, J.D., and A.B. Krueger. 1991. "Does compulsory school attendance affect schooling and earnings?" *The Quarterly journal of economics* 106(4): 979–1014.

- Anselin, L. 2019. "The Moran scatterplot as an ESDA tool to assess local instability in spatial association." In *Spatial Analytical Perspectives on GIS*, pp. 111-126. Edited by Manfred Fischer, Henk J Scholten, and David Unwin. London: Routledge.

- Anselin, L. and S. Ray. 2014. "Two stage least squares." In: *Modern Spatial Econometrics in Practice: A guide to GeoDa, GeoDaSpace, and PySAL*, pp. 139-142. GeoDa Press LLC.

- Arbia, G. 2014. "The classical linear regression model." In: *A Primer for Spatial Econometrics: With Applications in R*, pp. 1-25. Palgrave Maximillian.

- Baum-Snow, N., M.E. Kahn & R. Voith. 2005. "Effects of urban rail transit expansions: Evidence from sixteen cities, 1970-2000." *Brookings-Wharton Papers on Urban Affairs*, 147-206.

- Cartone, A., D. Panzera, & P. Postiglione. 2021. "Regional economic disparities, spatial dependence and proximity structures." *Regional Science Policy & Practice.* https://doi.org/10.1111/rsp3.12482

- Celebioglu, F. & S. Dall'erba. 2010. "Spatial disparities across the regions of Turkey: An exploratory spatial data analysis." *Annals of Regional Science* 45(2): 379-400.

- Chica-Olmo, J., Sari-Hassoun, S., & Moya-Fernández, P. 2020. Spatial relationship between economic growth and renewable energy consumption in 26 European countries. *Energy Economics*, *92*, 104962.

- Corrado, L. & B. Fingleton. 2012. "Where is the economics in spatial econometrics?" Journal of Regional Science, 52(2), 210–239. https://doi.org/10.1111/j.1467-9787.2011.00726.x

- Davis, D.R. & D.E. Weinstein. 2002. "Bones, bombs, and break points: The geography of economic activity." *The American Economic Review*, 92(5), 1269-1289.

- Elhorst, J.P. 2014. "Spatial panel data models." In *Spatial Econometrics from Cross-Sectional Data to Spatial Panels*, pp. 37-93. Berlin, Heidelberg: Springer.

- Elhorst, J.P. 2010. "Applied spatial econometrics: Raising the bar." *Spatial Economic Analysis* 5(1): 9-28.

- Feng, Z., & Chen, W. 2018. Environmental regulation, green innovation, and industrial green development: An empirical analysis based on the Spatial Durbin model. Sustainability, 10(1), 223.

- Flores, M. & Rodriguez-Oreggia, E. 2014, "Spillover Effects on Homicides across Mexican Municipalities: A Spatial Regime Model Approach", *The Review of Regional Studies*, vol. 44, no. 3, pp. 241-262.

- Fotheringham, A.S., C. Brunsdon & M. Charlton. 2007. "Statistical inference for spatial data." In: Fotheringham, A.S., Brunsdon, C., & Charlton, M. (eds.) *Quantitative Geography*. pp. 184-211. London: SAGE Publications Ltd.

- Fujita, M., P.R. Krugman & A. Venables. 2001. *The spatial economy: Cities, regions, and international trade*. MIT press.

- Getis, A. 2009. "Spatial weights matrices." *Geographical Analysis*, 41(4), 404-410.

- Gibbons, S. & H.G. Overman. 2012. "Mostly pointless spatial econometrics?" *Journal of Regional Science* 52(2): 172-191.

- Griffith, D.A., and J.H.P. Paelinck. 2007. "An equation by any other name is still the same: on spatial econometrics and spatial statistics." The Annals of Regional Science 41, no. 1: 209-227.

- Griffith, D.A. & Y. Chun. 2014. "Spatial Autocorrelation and Spatial Filtering" In*: Handbook of Regional Science*. M.M. Fischer, MM and P. Nijkamp. (1st eds.), pp. 91-130. Springer-Verlag Berlin Heidelberg. doi:10.1007/978-3-642-23430-9_72.

- Gu, H., Yan, W., Elahi, E., & Cao, Y. (2020). Air pollution risks human mental health: an implication of two-stages least squares estimation of interaction effects. *Environmental Science and Pollution Research*, 27, 2036-2043.

- Jackson, M. C., Huang, L., Xie, Q., & Tiwari, R. C. 2010. A modified version of Moran's I. *International journal of health geographics*, *9*(1), 1-10. https://ij-healthgeographics.biomedcentral.com/articles/10.1186/1476-072X-9-33

- Kisiała, W. 2017. Spatial Cross-Regressive Models in the Study of the Spatial Diffusion of Innovation in Central Europe. *Research Papers of Wrocław University Of Economics.* no. 476: 97–105. https://doi.org/10.15611/pn.2017.476.09.

- LeSage, J.P., and Christine Thomas-Agnan. 2015. "interpreting spatial econometric origin-destination flow models." *Journal of regional science* 55, no. 2: 188–208.

- LeSage, J.P., and R.K. Pace. 2009. *Introduction to spatial econometrics*. Boca Raton, FL: CRC press.

- Li, G., S. Sun & C. Fang. 2018. "The varying driving forces of urban expansion in China: Insights from a spatial-temporal analysis." *Landscape and Urban Planning*, 174, 63-77.

- Livings, M. and A. Wu, 2020. "Local measures of spatial association." *The Geographic Information Science & Technology Body of Knowledge* (3rd Quarter 2020 Edition), John P. Wilson (Ed.)

- Lloyd, C. 2014. "Scale and multivariate data." In: *Exploring Spatial Scale in Geography*. John Wiley & Sons, Incorporated. pp. 106-111.

- Lukongo, O. E., & T. Miller. 2018. "Evaluating the spatial consequence of interest rate ceiling using a spatial regime change approach." *The American Economist*, 63(2), 166-186.

- Miura, K. 2011. "An introduction to maximum likelihood estimation and information geometry." *Interdisciplinary Information Sciences*, 17(3), 155-174.

- Nilsson, P. 2014. "Natural amenities in urban space–A geographically weighted regression approach." *Landscape and Urban Planning*, 121, 45-54.

- Partridge, M.D., M. Boarnet., S. Brakman, & G. Ottaviano. 2012. "Introduction: whither spatial econometrics?" *Journal of Regional Science* 52(2): 167-171.

- Patuelli, Roberto, Daniel A. Griffith, Michael Tiefelsdorf, and Peter Nijkamp. 2006. "The use of spatial filtering techniques: the spatial and space-time structure of German unemployment data." Tinbergen Institute Discussion Paper, No. 06-049/3, Tinbergen Institute, Amsterdam and Rotterdam.

- Pokropek, A. 2016. Introduction to instrumental variables and their application to large-scale assessment data. Large-scale Assessments in Education, 4, 1-20.

- Proost, S., & J. F. Thisse. 2019. "What can be learned from spatial economics?" *Journal of Economic Literature*, *57*(3), 575-643.

- Purwaningsih, T., A. Ghosh & C. Chumairoh. 2017. "Spatial data modeling in disposable income per capita in china using nationwide spatial autoregressive (SAR)." *International Journal of Advances in Intelligent Informatics*, 3(2), 98–106.

- Qian, S.S. 2016. "Multilevel linear regression." In: Environmental and Ecological Statistics with R (2nd ed.). Chapman and Hall/CRC. pp.436-452.

- Rocconi, L. M. 2013. Analyzing multilevel data: comparing findings from hierarchical linear modeling and ordinary least squares regression. *Higher Education*, 66(4), 439-461.

- Salvati, L. 2019. "Examining urban functions along a metropolitan gradient: a geographically weighted regression tells you more." *Letters in Spatial and Resource Sciences*, 12(1), 19-40.

- Sparks, P.J., and C.S. Sparks. 2010. "An application of spatially autoregressive models to the study of US county mortality rates." *Population, Space & Place* 16(6): 465-481.

- Tian, L., H.H. Wang & Y. Chen. 2010. "Spatial externalities in China regional economic growth." *China Economic Review* 21: S20-S31.

- Vega, S. H., & Elhorst, J. P. 2013. On spatial econometric models, spillover effects, and W. *In 53rd ERSA Congress, Palermo, Italy* (pp. 1-28).

- Wang, C.H., & N. Chen. 2015. "A GIS-based spatial statistical approach to modeling job accessibility by transportation mode: Case study of Columbus, Ohio." *Journal of Transport Geography*, 45, 1–11.

- Wang, Yiyi, Kara M. Kockelman, and Xiaokun Cara Wang. 2013. "Understanding spatial filtering for analysis of land use-transport data." Journal of Transport Geography 31: 123-131.

- Wu, A. & K.K. Kemp. 2019. "Global measures of spatial association." *The Geographic Information Science & Technology Body of Knowledge* (1st Quarter 2019 Edition), John P. Wilson (Ed.)

- Yin, C., M. Yuan, Y. Lu, Y. Huang & Y. Liu. 2018. "Effects of urban form on the urban heat island effect based on spatial regression model." *Science of the Total Environment, 634, 696–704.*

- Zeng, M., D. Jiang & W. Zhang. 2019. "Spatial-temporal effects of PM2.5 on health burden: Evidence from China." *International Journal of Environmental Research and Public Health*, 16(23), 4695–.

Description and Assessment of Assignments

Your grade in this course will be determined based on the basis of several different assessments:

Resume Assignment – 2 worth a total of 4 points. We require all current students to post and maintain a public resume, short biography and recent photo on our shared SSI Student Community Blackboard site. The resume is required to be prepared using the SSI template and following the SSI guideline.

  The first resume assignment is planned during the first week and can be resubmitted upon the improvement and timeline suggested by the instructor. A second resume assignment is planned toward the end of the course so you can add the skills learned from this course to enhance your resume.

Lead Reading and Research Discussion – 1 worth a total of 8 points. The reading and research discussions will focus on the theory portions of the course as presented in the weekly readings. Students will be paired as discussion lead and each pair leads one discussion on the assigned topic(s) once during the semester. The objective is to promote the students in evaluating and integrating course readings as well as to enhance public presentation and leadership skills. Each group (in pair) will prepare for an 8-10-minute opening statement presentation followed by 3 questions raised from the presentation material for class discussion. Pre-recorded videos would be allowed for asynchronous students to lead the reading and research discussion.

In-Class / Online Reading & Research Discussion (RRD) – 10 worth a total of 15 points. An in-class / online engagement grade will be assigned based upon student engagement for 10 reading & research discussions. Students unable to join class discussion synchronously will be able to obtain the grades by joining the online discussion forums within 72 hours after each class discussion. Failure to participate in the in-class / online discussion will receive no grade for that week. Student that leads the RRD that week is not required to post the answers online for the week, but is encouraged to monitor and respond to the other students' online posts by the end of the week.

Quizzes – 5 worth a total of 15 points. There would be quizzes on the lectures and readings from the previous weeks. The top 5 scores would be counted toward the final grade. There is no mid-term exam, so the quizzes are the assessment of how well the students have learned the material during the semester.

Projects – 4 worth a total of 31 points (Project 1,2,3 worth 7 points each, and Project 4 (i.e. Final Project) worth 10 points). Students will be assigned 4 project-based homework assignments during the course. The assignments include one research plan and three hands-on exercises on spatial techniques explored in theory in the texts. The last project is to develop a case study of spatial statistics and spatial econometrics using the methods learned throughout the course. Students will present the outcome as a Story Map in the final presentation (see below).

Final Presentation – 1 worth a total of 7 points. A final presentation of Project 4 outcomes using the format of Story Map will be delivered in the final week during the class session.

Final Exam – 1 worth a total of 20 points. A comprehensive final exam will be conducted during the final exam week following the university exam schedule.

Grading Breakdown

Assessment	Number	Points Each	Total Points
Resume Assignments	2	2	4
Reading and Research Discussions	8	1.875	15
Lead Reading & Research Discussion	1	8	8
Quizzes	5	3	15
Projects 1,2,3	3	7	21
Project 4	1	10	10
Final Presentation	1	7	7
Final exam	1	20	20
Total	24	-	100

Assignment Submission Policy

Assignments must be submitted via D2L by the due dates specified in the Course Schedule below and on the assignment instructions. Unless otherwise noted, all assignments are *due by 11:59 pm Pacific Time (PT) on the due dates*. Your attention to on-time assignment submission is essential.

Strict penalties apply for late assignments as follows:
- All assignments will be penalized 2 points up to FOUR days late. No points will be given for submissions more than FOUR days late. Note that all assignments worth 2 points will receive 0 points if submitted late.
- Additionally, no written work will be accepted for grading after 5 pm PT on the last day of classes.

Course Schedule: A Weekly Breakdown

	Topics	Readings and Assignments	Deliverables/Dues
Module 1: Overview of Spatial Economics and Spatial Econometrics			
Week 1			
1/8	Introduction to course	Fujita et al. (2001) Ch1 Resume Assignment	Resume Assignment 1: due Friday, 1/12
1/10	Introduction to spatial econometrics	LeSage & Pace (2009) Ch1	
Week 2			
1/17* *Monday, 1/15 is university holiday	Urban economics overview	Fujita et al. (2001) Ch2 Proost & Thisse (2019) Sec.4 Baum-Snow et al. (2005)	Sign-up for lead class discussion
Week 3			
1/22	Regional science overview	Fujita et al. (2001) Ch3 Proost & Thisse (2019) Sec.3 Davis & Weinstein (2002) **Project 1**	
Module 2: Connecting Spatial Statistics to Spatial Econometrics			
1/24	Neighborhood structure	Chi & Zhu (2019) Ch2 p.21-33 Griffith & Paelinck (2007)	
Week 4			
1/29	Spatial weights matrix I	Chi & Zhu (2019) p.33-41 Getis (2009)	Quiz 1
1/31	Spatial weights matrix II	Cartone et al. (2021)	
Week 5			

2/5	Spatial autocorrelation I: Global spatialassociation	Chi & Zhu (2019) p.41-46 Wu & Kemp (2019) Anselin (2019) Jackson et al. (2010)	
2/7	Spatial autocorrelation II: Local spatial association	Chi & Zhu (2019) p.47-53 Livings & Wu (2020) Celebioglu & Dall'erba. (2010)	Submit Project 1 on D2L by Wednesday 2/7
Module 3: Non-Spatial Regression Models			
Week 6			
2/12	Classic linear regression models (OLS) / regression in GIS	Arbia (2014) Ch1 **Project 2**	Quiz 2
2/14	Endogeneity, instruments and two stage least squares (2SLS)	Anselin & Ray (2014) pp. 139-142 Angrist & Krueger (1991) Pokropek (2016) Gu et al. (2020)	
Week 7			
2/21* ***Monday, 2/19 is university holiday**	Likelihood function & maximum likelihood estimation	Muira (2011)	
Week 8			
2/26	Motivation of regression for spatial econometrics models	LeSage and Pace (2014) Ch2 Chi & Zhu (2019) Sec 3.1 pp.55-64	Sign-up to check-in with Instructor on project data acquisition
Module 4: Spatial Regression Models			
2/28	Spatial autoregressive (SAR) process	Lloyd (2014) Sec. 5.5 pp.106-111 Purwaningsih et al. (2017)	Submit Project 2 on D2L by Wednesday, 2/28
Week 9			

3/4	Spatial lag models (SLM) & spatial error models (SEM)	Chi & Zhu (2019) Sec 3.2 - 3.3 pp.74-83 Wang and Chen (2015) Yin et al. (2018) **Project 3**	Quiz 3 Data check-in meeting this week
3/6	(Guest talk on spatial data resources and/or spatial econometrics research: TBD)		

| 3/11-3/17 is Spring Recess ||||

Week 10			
3/18	Examples of SAR models & spatial Durbin model I	Elhorst (2010) Zeng et al. (2019)	Quiz 4 Data check-in meeting (continued)
3/20	Spatial Durbin model II & intro to conditional autoregressive models (CAR)	Feng & Chen (2018)	

Week 11			
3/25	Spatial cross-regressive models	Chi & Zhu (2019) Sec 4.1-4.2 pp. 85-97 Kisiala (2017)	
3/27	Models dealing with spatial heterogeneity I: Spatial regime models	Chi & Zhu (2019) Sec 5.1-5.2 pp.113-126 **Project 4**	Submit Project 3 on D2L by Wednesday, 3/27

Week 12			
4/1	Models dealing with spatial heterogeneity II: Geographically weighted regression	Chi & Zhu (2019) Sec 5.3 pp.127-138 Nilsson (2014) Salvati (2019)	Quiz 5

Module 5: Advanced Spatial Econometrics Models			
4/3	Dealing with both spatial dependency and spatial heterogeneity	Chi & Zhu (2019) Ch 6 Lukongo & Miller (2018) Flores & Rodriguez_Oreggia (2014)	

Week 13			
4/8	Multilevel linear regression models (MLR)	Chi & Zhu (2019) Sec. 4.3 pp. 98-110 Qian (2016) Sec. 10.4 pp. 436-452. Rocconi (2013) Resume assignment 2	
4/10	Spatial panel models	Chi & Zhu (2019) Ch7 pp.155-167 Elhorst (2014) pp.37-53; 53-93 Chica-Olmo et al. (2020)	
Week 14			
4/15	Problems & critiques of spatial econometrics models	Li et al. (2018) Vega and Elhorst (2013) Patridge et al. (2012)	Quiz 6 Submit Resume Assignment 2 by Friday, 4/12
4/17	Practical applications of spatial econometric models & summative discussion	Sparks & Sparks (2010) Tian et al. (2010) LeSage & Thomas-Agnan (2015)	
Week 15			
4/22 *Friday, 4/26 is the last day of class	Project presentation I & quiz review		Submit Project 4 by Monday, 4/22 @ 8 am PT
4/24	Project presentations II & course review		Project presentations of the Project 4 storymap during class time (4/22 or 4/24)
Final Exam	Final Exam follows the university schedule on **Friday, May 3rd, 8-10 am PT**		

Statement on Academic Conduct and Support Systems

Academic Integrity:

The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, comprises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It

stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct. Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for

people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - *(213) 740-9355(WELL) – 24/7 on call*

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - *(213) 740-5086*

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - *(213) 740-5086 or (213) 821-8298*

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - *(213) 740-0776*

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - *(213) 740-0411*

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - *(213) 740-2101*

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - *UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - *UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call*

Non-emergency assistance or information.

Office of the Ombuds - *(213) 821-9556 (UPC) / (323-442-0382 (HSC)*

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - *(323) 442-2850 or* otfp@med.usc.edu

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.