University of Pennsylvania
The Wharton School

Advanced Topics in Urban Economics:
Quantitative Spatial Models for Urban Economics
Fall 2025
REAL9440

Updated August 2025

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Office Hours: Tuesdays 2pm-3pm (Dinan 447)
and by appointment

Classroom: Steinberg-Dietrich Hall 217
Time: Tuesdays, 3:30-6:30pm

This course will cover quantitative spatial models (QSMs) as used in urban and real estate economics and related disciplines. We will critically explore QSMs both as tools for measurement and as economic frameworks for evaluating welfare and simulating counterfactuals of spatial economies. We will discuss approaches to QSM estimation, as well as data requirements, identifying assumptions, and the consequences thereof. The purpose of this course is to give students a broad understanding of QSMs and their common use cases, while providing a sense of the circumstances and assumptions under which these models permit credible analysis.

We may explore applications of QSMs to a variety of economic topics: infrastructure, transit, congestion, land use, migration, path dependence, economic history, the geography of consumption, household economics, environmental economics, climate change

Recommended background readings (optional)

- Eaton & Kortum. (2002). Technology, geography, and trade. *Econometrica*, *70*(5), 1741-1779.
- Train (2009). *Discrete choice methods with simulation*. Cambridge University Press.

* denotes required reading (in suggested order of reading)
‡ denotes option for student presentations

Week 1 (August 26, 2025)

Preliminaries
Gravity, Aggregation & Market Access, A Very Simple Analytic Quantitative Model, and Connections and Related Contexts

Readings

- Baum-Snow, Hartley, & Lee. (2019). The Long-Run Effects of Neighborhood Change on Incumbent Families (No. WP-2019-2).
- Kreindler & Miyauchi. (2023). Measuring commuting and economic activity inside cities with cell phone records. *Review of Economics and Statistics*, 105(4), 899-909.
- Redding & Weinstein. (2019). Aggregation and the Gravity Equation. *AEA Papers and Proceedings* 109, pp. 450-455.
- Silva & Tenreyro. (2006). The Log of Gravity. *The Review of Economics and Statistics*, 641-658.

Week 2 (September 2, 2025)

A Regional QSM with Costly Trade, An Urban QSM with Commuting, Market Access in Action, and Menu of Models

<u>*Readings*</u>

- (*) Donaldson & Hornbeck. (2016). Railroads and American economic growth: A "market access" approach. *Quarterly Journal of Economics*, 131(2), 799-858.
- (*) Tsivanidis. (2022). *Evaluating the impact of urban transit infrastructure: Evidence from bogota's transmilenio.*
- (*) Ahlfeldt, Redding, Sturm, & Wolf. (2015). The economics of density: Evidence from the Berlin Wall. *Econometrica*, 83(6), 2127-2189.
- Behrens & Murata. (2021). On quantitative spatial economic models. *Journal of Urban Economics*, 123, 103348.
- Brinkman & Lin. (2022). Freeway revolts! The quality of life effects of highways. *Review of Economics and Statistics*, 1-45.
- Franklin, Imbert, Abebe, & Mejia-Mantilla. (2024). Urban public works in spatial equilibrium: Experimental evidence from Ethiopia. American Economic Review, 114(5), 1382-1414.
- Redding, & Sturm. (2008). The costs of remoteness: Evidence from German division and reunification. *American Economic Review*, 98(5), 1766-1797.
- Severen. (2023). Commuting, labor, and housing market effects of mass transportation: Welfare and identification. *Review of Economics and Statistics*, 105(5), 1073-1091.

Week 3 (September 9, 2025)

Estimation and Identification, Characterization -- Existence and Uniqueness, Inversion and Recovering Fundamentals, and Counterfactuals and Hat Algebra

<u>*Readings*</u>

- (*) Allen, Arkolakis, & Li. (2015) "On the existence and uniqueness of trade equilibria."
  … I prefer the above version, but this paper evolved into:
  - Allen, Arkolakis, & Li. (2020). On the equilibrium properties of network models with heterogeneous agents (NBER 27837).
  - Allen, Arkolakis, & Li. (2024). On the equilibrium properties of spatial models. *American Economic Review: Insights*, 6(4), 472-489.
- (*) Redding & Turner. (2015). Transportation costs and the spatial organization of economic activity. *Handbook of Regional and Urban Economics*, *5*, 1339-1398.
- Allen, Arkolakis, & Takahashi. (2020). Universal gravity. *Journal of Political Economy*, *128*(2), 393-433.
- (‡) Baum-Snow & Han. (2024). The Microgeography of Housing Supply. *Journal of Political Economy*, 132(6), 1897-1946.
- Dingel & Tintelnot. (2025). *Spatial economics for granular settings* (NBER 27287).
- Garg (2025). Can Industrial Policy Overcome Coordination Failures? Theory and Evidence.

CODING ASSIGNMENT DUE FRIDAY, SEPTEMBER 12

Week 4 (September 16, 2025)

A Very Simple QSM with Costly Migration, Migration and Frictions, Multiple Groups and Non-Homotheticity, and Multiple, Endogenous, and Complex Linkages

DISCUSS LITERATURE REVIEW / RESEARCH TOPIC WITH PROFESSOR

Readings

- (*) Monte, Redding, & Rossi-Hansberg. (2018). Commuting, migration, and local employment elasticities. *American Economic Review*, 108(12), 3855-3890.
- (*) Miyauchi, Nakajima, & Redding. (2021). *The economics of spatial mobility: Theory and evidence using smartphone data* (NBER 28497).
- (*) Almagro, Chyn, & Stuart. (2023). *Urban Renewal and Inequality: Evidence from Chicago's Public Housing Demolitions* (NBER 30838).
- Allen & Arkolakis. (2022). The welfare effects of transportation infrastructure improvements. *Review of Economic Studies*, 89(6), 2911-2957.
- (‡) Arkolakis, Huneeus, & Miyauchi. (2023). *Spatial production networks* (NBER 30954).
- (‡) Bordeu. (2023). "Commuting infrastructure in fragmented cities."
- (‡) Faber & Gaubert (2021). Faber, B., & Gaubert, C. (2019). Tourism and economic development: Evidence from Mexico's coastline. *American Economic Review*, 109(6), 2245-2293.
- Fajgelbaum & Gaubert. (2020). Optimal spatial policies, geography, and sorting. *Quarterly Journal of Economics*, 135(2), 959-1036.
- Fajgelbaum & Schaal. (2020). Optimal transport networks in spatial equilibrium. *Econometrica,* 88(4), 1411-1452.
- Fuchs & Wong. (2024). *Multimodal transport networks*.
- (‡) Morten & Oliveira. (2024). The effects of roads on trade and migration: Evidence from a planned capital city. *American Economic Journal: Applied Economics*, 16(2), 389-421.
- Santamaria. (2020). *Reshaping Infrastructure: Evidence from the division of Germany*.

Week 5 (September 23, 2025)

Dynamics & Path Dependence

Readings

- (*) Allen & Donaldson. (2020). *Persistence and path dependence in the spatial economy* (NBER 28059).
- (*) Caliendo, Dvorkin, & Parro. (2019). Trade and labor market dynamics: General equilibrium analysis of the china trade shock. *Econometrica*, 87(3), 741-835.
- (‡) Almagro & Domínguez-Iino. (2024). *Location sorting and endogenous amenities: Evidence from Amsterdam* (NBER 32304).
- (‡) Balboni. (2025). In harm's way? infrastructure investments and the persistence of coastal cities. *American Economic Review*, *115*(1), 77-116.
- (‡) Bilal & Rossi-Hansberg. (2021). Location as an Asset. *Econometrica*, 89(5), 2459-2495.
- Howard, G., & Shao, H. (2023). The dynamics of internal migration: A new fact and its implications.
- Kleinman, Liu, & Redding. (2023). Dynamic spatial general equilibrium. *Econometrica*, 91(2), 385-424.
- Monte, Porcher, & Rossi-Hansberg. (2023). *Remote work and city structure* (NBER 31494).
- (‡) Porcher, C. (2022). Migration with costly information.
- (‡) Warnes, P. (2024). Transport infrastructure improvements and spatial sorting: Evidence from Buenos Aires. [link]

Week 6 (September 30, 2025)

QSMs as Data; QSMs, New Data, and Old Data, Robustness and Empirical Challenges, Alternative Approaches to Estimation (and Big Choice Sets), Recent JMPs Featuring QSMs

TOPICAL LITERATURE REVIEW DUE SEPTEMBER 30

Readings

- (*) Heblich, Redding, & Sturm. The making of the modern metropolis: evidence from London. *Quarterly Journal of Economics*, 135(4), 2059-2133.
- (*) Adão, Costinot, & Donaldson. (2025). Putting Quantitative Models to the Test: An Application to the US-China Trade War. *Quarterly Journal of Economics*, 140(2), 1471-1524.
- (‡) Alves, Burton, & Fleitas. (2023). *Difference-in-Differences in Equilibrium: Evidence from Placed-Based Policies.*
- Andrews, Gentzkow, & Shapiro. (2017). Measuring the sensitivity of parameter estimates to estimation moments. *Quarterly Journal of Economics*, 132(4), 1553-1592.
- Bagagli, S. (2023). The (Express) Way to Segregation: Evidence from Chicago. Job Market Paper.
- Bellégo, Benatia, & Pape. (2022). *Dealing with logs and zeros in regression models*.
- Borusyak & Hull. (2023). Nonrandom exposure to exogenous shocks. *Econometrica*, 91(6), 2155-2185.
- (‡) Davis, D. R., Dingel, J. I., Monras, J., & Morales, E. (2019). How segregated is urban consumption? *Journal of Political Economy*, 127(4), 1684-1738.
- (‡) Easton, M., & Farrell, P. W. (2024). *Populations in Spatial Equilibrium*.
- (‡) Heblich, Nagy, Trew, Zylberberg. (2025). *The Death and Life of Great British Cities*.
- Lind & Ramondo. (2023). Trade with correlation. *American Economic Review*, 113(2), 317-353.
- Nagengast & Yotov. (2025). Staggered difference-in-differences in gravity settings: Revisiting the effects of trade agreements. *American Economic Journal: Applied Economics*, 17(1), 271-296.
- (‡) Weiwu, Laura. (2024). "Unequal access: Racial segregation and the distributional impacts of interstate highways in cities."

Week 7 (October 7, 2025)

Student presentations
Overflow from prior weeks

STUDENT PRESENTATIONS

Assessment:

Assessment for the course will be based on the following:

- Class Participation (10%), every week
- Coding Assignment (20%), due the Friday after Week 3 class
- Paper Discussion (25%), varies by student
- Topical Literature Review (20%), due Week 6 at beginning of class
- Research Proposal (25%), due Week 7 in class

Coding Assignment

Assignment will be given in Week 1 and is due on Friday, September 12.

Paper Discussion

In most sessions, we will cover two to three papers in detail. For each of one or two papers during Week 3 through Week 6, a student will present the paper and provide a critical evaluation of it. Paper discussions will be finalized once there is an accurate headcount of students.

Class Participation

Students are expected to have carefully read and reviewed each starred paper in advance of class, and may be called on to answer questions about each paper. Before each class, students will prepare at least one question or comment about the starred paper.

Literature Review and Research Proposal

Students will develop a proposal for a research project that uses a QSM and review the relevant literature. Topics should be discussed with me by the end of Week 4, either in a meeting or via email.

Each student will prepare a literature review of at least two full pages and no more than four full pages on the agreed upon topic. This assignment will be due in class during Week 6.

Each student will then present their research proposal in class during Week 7 (time permitting). Students should email me slides for their proposal before Week 7 class. The research proposal should include:

- An interesting, feasible, and clear research question
- Brief background describing the contribution of the proposed project
- A discussion of possible data
- A research design targeted at answering the proposed research question
- How does a QSM help you answer that question?

Other Policies

Generative AI. You may use Generative AI programs (e.g., ChatGPT) to help generate ideas, brainstorm, and guide your literature search. However, materials generated by these programs may be inaccurate, incomplete, or otherwise problematic. Using AI can, at times, also stifle your own independent, critical, and creative thinking.

You may <u>not</u> submit any work generated by an AI program as your own. If you include material generated by an AI program, it should be cited like any other reference material (with due consideration for the quality of the reference, which may be poor). You should validate anything generated by AI (see example below), as I may remove points for nonfactual statements or code that does not execute properly.

Any plagiarism or other form of cheating will be dealt with severely under relevant Penn policies.

> Example Problem with AI: *Rebecca Diamond's 2016 AER is an important precursor to the current QSM modeling space. When asking ChatGPT to describe the paper, it describes her model as a "dynamic, heterogeneous-agent model with endogenous amenities and labor market sorting," and specifically says that the paper "[t]reats location choice as a forward-looking decision with moving costs" and later formulates the location choice problem as a dynamic program [OpenAI, v. Aug 10, 2025]. This is incorrect.*

Email Responsiveness. I will endeavor to respond to emails within 24 hours, with some additional time on weekends or if I am on vacation. Please note that I am taking PTO from my primary workplace to teach.