# Carol Xiaomiao Gao

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## Education

**Massachusetts Institute of Technology** 2024-Present
Ph.D. student in Operations Research
Advisor: Prof. Dimitris Bertsimas

**Smith College** 2018-2022
A.B. Mathematics, A.B. Quantitative Economics (High Honors) GPA: 3.99/4.00

## Research Experience

**MIT Sloan School of Management** August 2022 - Present
*Research Assistant* for *Prof. Dimitris Bertsimas* *Cambridge, MA*

- Derived tractable linear robust counterpart accounting for uncertainty in surgery duration and length of stay, and formulated optimization problem to assign the times and locations of elective surgeries to minimize cost while maintaining a balanced daily census.
- Formulated stability in many-to-one matching as a convex optimization problem and developed an algorithm to assign students to public school while minimizing the number of blocking pairs and total transportation cost.
- Utilized optimal classification trees to identify patients at high risks for sepsis using pre-blood-culture data and eliminate unnecessary blood and urine testings.

**MIT Blueprint Labs** June 2022 - June 2024
*Research Assistant* for *Prof. Parag Pathak* and *Prof. Joshua Angrist* *Cambridge, MA*

- Leveraged randomization in the Deferred-Acceptance (DA) mechanism and used travel time to offered schools as the instrument to estimate the causal effect of student travel on academic achievement.
- Evaluated school value-added using school assignments as instruments for enrollment and formed empirical Bayes posteriors using obtained IV estimates to further explore the minimal effect on achievement.
- Estimated individual preference for travel using rank-ordered mixed logit model to analyze heterogeneous effect of travel across families with difference travel preferences.

**Smith College, Department of Economics** August 2021 - May 2022
*Research Assistant* for *Prof. Lucie Schmidt* *Northampton, MA*

- Selected and created variables from the Survey of Low-Income Aged & Disabled (SLIAD), then employed difference-in-differences design to examine the effect of food stamp eligibility on family security of SSI recipients.
- Explored the newly released Children Development Supplement (CDS) data and extracted information on family structure to perform analyses on the effect of Social Security income on children's academic performance.

**Smith College, Department of Economics** February 2021 - August 2021
*Research Assistant* for *Prof. Mariyana Zapryanova* *Northampton, MA*

- Cleaned and merged policing and crime data in Chicago, then selected and created variables that proxy for parameters in the theoretical model.
- Used spatial polygon data to identify adjacent police districts in Chicago and created visualizations of spatial distributions of policing and crime rates in R.
- Employed spatial Durbin model to examine the spillover effect of policing and vigilance.
- Utilized difference-in-differences and event study designs to analyze the changes in police arrest behavior following a BLM protest by comparing between crime incidents closer and farther from a protest.

**Smith College, Department of Economics** December 2019 - February 2021
*Research Assistant* for *Prof. Jorge Vásquez* *Northampton, MA*

- Created a model of optimal criminal search and solved for the optimal allocations of policing that minimize total crime rates in the cases of observed and unobserved policing.
- Theoretically examined the effect of increasing policing and penalty on crime reduction, accounting for search behavior, and provided policy implications.
- Simulated and visualized the model in MATLAB and Mathematica to analyze the model numerically.

**Smith College, Department of Mathematics** February 2020 - May 2020
*Research Assistant* for *Prof. Tian An Wong* *Northampton, MA*

- Developed discrete definition of compactness scores in the context of dual graphs of district maps.
- Compared and tested different scores and evaluated their mitigation of four main issues of gerrymandering.

## Publications

"Instrumental Variables in Randomized Trials"
Joshua Angrist, **Carol Gao**, Peter Hull, Robert W. Yeh.
*NEJM Evidence*, 4.4 (2025): EVIDctw2400204.

"Optimal Policing with (and without) Criminal Search"
**Carol Gao**, Jorge Vásquez.
*Review of Economic Design*, 29, 213–244 (2025).

## Working Papers

"Instrumental Variables with Time-Varying Exposure: New Estimates of Revascularization Effects on Quality of Life"
Joshua Angrist, Bruno Ferman, **Carol Gao**, Peter Hull, Otavio L. Tecchio, Robert W. Yeh.

"The R.O.A.D. to Clinical Trial Emulation"
Dimitris Bertsimas, Angelos G. Koulouras, Hiroshi Nagata, **Carol Gao**, Junki Mizusawa, Yukihide Kanemitsu, Georgios Antonios Margonis.

## Work in Progress

"Should we Relax Stability in Matching Markets?" with Dimitris Bertsimas.

"Robust Surgery Scheduling and Block Assignment" with Dimitris Bertsimas and Kimberly Villalobos Carballo.

"Predicting Central Line Associated Blood Stream Infection Using Multimodal Artificial Intelligence" with Dimitris Bertsimas and Phevos Paschalidis.

## Conferences

*"Using Holistic AI to Diagnose Injury Grade for Liver Injuries"*
INFORMS Annual Meeting, Seattle October 2024
Annual Holistic AI in Medicine (HAIM) Summit, Hartford Healthcare November 2024

*"The Effect of Black Lives Matter Protests on Crime and Arrest Rates: Evidence from Chicago"*
Promoting Inclusion in Economic Research (PIER) Conference, Williams College May 2022
Issues in Political Economy 28th Annual Conference, New York February 2022

*"Criminal Displacement and Optimal Policing"*
PIER Conference, Williams College May 2021

*"Discrete Compactness Scores and Political Gerrymandering"*
Hudson River Undergraduate Mathematics Conference (Cancelled due to COVID-19) April 2020

## Honors and Awards

**Ann Kirsten Pokora Prize** to a senior with a distinguished academic record in Mathematics May 2022
**Samuel Bowles Prize** for the best thesis on an economics subject May 2022
**Sidney S. Cohen Prize** for outstanding work in the field of economics May 2022
**Suzan Rose Benedict Prize** to a sophomore for excellence in Mathematics May 2020
**Dean's List** 2019-2022

## Teaching Experience

**MIT, Sloan School of Management** September 2025 - December 2025
*Teaching Assistant* for *Machine Learning Under a Modern Optimization Lens (15.095)*

· Graduate level course on ML tools via robust, convex and mixed integer optimization.
· Led recitations and weekly office hours, developed and graded assignments, supervised final projects.

**MIT, Sloan School of Management** February 2025 - May 2025
*Teaching Assistant* for *Analytics for a Better World (15.076)*

· Undergraduate level course on optimization and machine learning.
· Led recitations and weekly office hours, developed and graded assignments, supervised final projects.

**Smith College, Department of Economics** September 2020 - December 2020
*Teaching Assistant* for *Intro to Macroeconomics and Intermediate Macroeconomics*

· Held weekly tutoring hours for assignments and review sessions before exams.
· Prepared and typesetted solutions to problem sets and graded problem sets.

## Skills and Languages

**Programming** Stata, R, Python, Julia, MATLAB, HTML, CSS
**Software** LaTeX, Mathematica, Gurobi, JuMP, TensorFlow
**Languages** Native proficiency in English and Chinese, working proficiency in Japanese