

Personal Statement

Research

I am an econometrician with research interests in causal inference. I primarily focus on developing new methods for causal inference in a more realistic setting of **treatment effects heterogeneity**. I have also contributed research on **weak identification** and the **synthetic control method**.

Heterogeneous effects

Much of my research in this area focuses on event studies, a widely used tool in economic policy analysis. Event studies estimate the impact of a new policy or intervention by comparing the average changes in outcomes of the treated group around the time of the policy's introduction with the average changes in outcomes of some comparison group. My research makes a novel contribution by proving that the traditional implementation of event studies can produce misleading results because it assumes the policy impact is constant over time and across groups. In "Estimating Dynamic Treatment Effects in Event Studies with Heterogeneous Treatment Effects" (*Journal of Econometrics*, 2021), Sarah Abraham and I show that the traditional implementation is especially problematic when the comparison group includes individuals who are treated at a later time, as it fails to distinguish between the impacts on the treated group and the comparison group. We propose a more robust alternative estimator that distinguishes the impacts of different groups. This estimator has now been widely adopted in applied economics research, supported by the Stata package I developed. In "A Linear Panel Model with Heterogeneous Coefficients and Variation in Exposure" (*Journal of Economic Perspectives*, 2022), Jesse Shapiro and I address similar challenges when the comparison group includes individuals who are less exposed to the policy than the treated group. Traditional implementation of event studies in this context conflates the variation in exposure with variation in impacts, and can therefore overstate or understate the average impacts.

Most recently, in "Double Robustness for Complier Parameters and a Semiparametric Test for Complier Characteristics" (*Econometrics Journal*, 2024), coauthored with Rahul Singh, we introduce methods to assess if an instrumental variable estimate reflects the general population or just a subset influenced by the instrument. Our method can be flexibly applied to high-dimensional datasets, which improves upon similar methods that existed in the literature.

My ongoing agenda investigates how to incorporate heterogeneous effects of a policy intervention into policy decisions. Applications to this agenda include how to allocate social services efficiently when costs and benefits vary across individuals, and data on these factors is limited.

Weak Identification/Model Misspecification

My second research focus investigates when traditional causal inference methods remain reliable, especially under weak model misspecification. Economists develop models to estimate

economic relationships and quantify the uncertainty around their estimates. While econometric methods exist to assess model specification, economic data often lacks the power to reliably detect misspecifications. As a result, researchers frequently rely on traditional causal inference methods that assume the model is correctly specified. However, when the model is even mildly misspecified, these methods can produce biased and highly variable estimates.

For example, economists studying the impact of education on earnings know that even after controlling for many observed covariates, education decisions may also be influenced by unobserved factors that affect earnings. To isolate education's causal effect, economists use "instrumental variables" — external factors that influence education level but not earnings directly. One important model misspecification in this example happens when these instruments are weak (barely shifting education levels). It is well known that traditional inference methods are unreliable under weak instruments, and a vast econometric literature has developed methods to detect weak instruments when there are few instruments. In "Inference with Many Weak Instruments" (*Review of Economic Studies*, 2022), coauthored with Anna Mikusheva, we make an important theoretical contribution for detecting weak instruments when there are many weak instruments, which is particularly important for high-dimensional data. This serves as a significant conceptual contribution and provides the foundation for several recent papers in the literature. We also develop new inference methods that remain valid under many weak instruments, and in our follow-up paper ("Weak Identification with Many Instruments", *Econometrics Journal*, 2024), we examine how to address situations with high-dimensional covariates.

Going forward, together with Tim Armstrong and Pat Kline, we study how to balance variance and bias in estimation when models are only mildly misspecified. This project creatively combines the theory of adaptation from statistics with the theory of local asymptotics, and I've presented at several invited seminars, such as the Online Chamberlain Seminar.

Synthetic Control Method

My other econometrics work has focused on improving the empirical practice for applying the synthetic control method. Synthetic control method is a popular tool to estimate the policy impact using aggregated panel data. Eli Ben-Michael, Avi Feller, and I study the properties of synthetic control methods using a novel perspective from high-dimensional statistics. This allows us to derive useful guidance in practically relevant settings that are not covered in the classical setting of single-outcome and annual data. In "Temporal Aggregation for the Synthetic Control Method," featured in the prestigious *AEA Papers and Proceedings* (2024), we propose smoothing high-frequency data as a preprocessing step, which is particularly useful for analyzing finance data. In "Using Multiple Outcomes to Improve the Synthetic Control Method," we propose combining multiple correlated outcomes into an index when applying the synthetic control method. The classical synthetic control method analyzes multiple outcomes one at a time, and our proposal makes the synthetic control method more applicable by allowing researchers to analyze multiple outcomes simultaneously.

Education and Institutional Citizenship

I have taught at the master's and PhD levels. At the master's level, I teach **Advanced Microeconometrics** and **Program Evaluation**. I substantially updated the syllabus for these two courses and developed new approaches to pedagogy via monte carlo simulations. The new material I incorporated, such as machine learning, better prepares the students for analyst jobs in consulting, data science, and public policy. Because of the positive experience, several of my students applied and won full scholarships to top PhD programs. At the PhD level, I teach **Advanced Topics in Econometrics** where I developed an innovative curriculum covering frontier causal inference methods. Students across the fields have found this course helpful for their academic development. My teaching material on "event studies" has national and international reach. For example, I have taught "event studies" at the NBER Summer Institute explained below, and to research professionals at University of Exeter Business School.

I have served a variety of institutional roles. At UCL, I serve as the **deputy graduate tutor** (DGT) for MSc, MRes, MPhil and PhD students in the department of economics. I work closely with the program directors, coordinate and examine MPhil upgrade seminars, thus contributing to a successful internal academic process. I have **initiated a mentoring programme** where I meet with students one-on-one, actively listening to their concerns and connecting them with resources to support their well-being. I have made **a personal impact on equality, diversity and inclusion in this initiative**. As the only asian female graduate tutor, I bring a unique perspective and use my experiences to build confidence among students from similar backgrounds. I am also the faculty coordinator representing UCL for [ENTER](#), a prestigious network that connects students across eight leading economics departments in Europe. At CEMFI, I coordinated the María de Maeztu Visitor Program to arrange visits by leading international scholars for 2022-2023.

Public Engagement

I am **a respected provider of short courses for professional development**. Together with Jesse Shapiro, I developed and presented a master course on "event studies" in July 2023 for the [NBER Summer Institute methods lecture](#). The NBER is a renowned institution promoting economics research and invites only prominent senior faculty members for the keynote. Attendees of my lecture include not only academic economists, but also economists from governments and businesses. Additionally, I have **engagement with international policy working groups**. I published a peer-reviewed [policy report](#) for the International Monetary Fund (IMF), and discussed the results with policymakers in the European Department at the IMF. I used my econometrics expertise to evaluate the reliability of economic indicators that the IMF routinely publishes to assess the structural performance of a given country, such as the IMF's Structural and Financial Indicators database.

Publication List

- Sun, L., Ben-Michael, E., & Feller, A. (2024). Temporal Aggregation for the Synthetic Control Method. In *Proceedings of the One Hundred Thirty-Sixth Annual Meeting of the American Economic Association*. San Antonio, TX, USA: American Economic Association. doi:[10.1257/pandp.20241050](https://doi.org/10.1257/pandp.20241050)
- Mikusheva, A., & Sun, L. (2024). Weak Identification with Many Instruments. *Econometrics Journal*. doi:[10.1093/ectj/utae007](https://doi.org/10.1093/ectj/utae007)
- Singh, R., & Sun, L. (2023). Double Robustness for Complier Parameters and a Semiparametric Test for Complier Characteristics. *Econometrics Journal*. doi:[10.1093/ectj/utad019](https://doi.org/10.1093/ectj/utad019)
- Sun, L., & Shapiro, J. M. (2022). A Linear Panel Model with Heterogeneous Coefficients and Variation in Exposure. *Journal of Economic Perspectives*, 36(4), 193-204. doi:[10.1257/jep.36.4.193](https://doi.org/10.1257/jep.36.4.193)
- Mikusheva, A., & Sun, L. (2022). Inference with Many Weak Instruments. *The Review of Economic Studies*, 89(5), 2663-2686. doi:[10.1093/restud/rdab097](https://doi.org/10.1093/restud/rdab097)
- Sun, L., & Abraham, S. (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, 225(2), 175-199. doi:[10.1016/j.jeconom.2020.09.006](https://doi.org/10.1016/j.jeconom.2020.09.006)
- Andrews, I., Stock, J. H., & Sun, L. (2019). Weak Instruments in Instrumental Variables Regression: Theory and Practice. In P. Aghion, & H. Rey (Eds.), *ANNUAL REVIEW OF ECONOMICS, VOL 11, 2019* (Vol. 11, pp. 727-753). ANNUAL REVIEWS. doi:[10.1146/annurev-economics-080218-025643](https://doi.org/10.1146/annurev-economics-080218-025643)
- Sun, L. (2018). Implementing valid two-step identification-robust confidence sets for linear instrumental-variables models. *STATA JOURNAL*, 18(4), 803-825. doi:[10.1177/1536867X1801800404](https://doi.org/10.1177/1536867X1801800404)