Environment and Development Economics

AREC 845, Spring 2024

Syllabus

January 31, 2024

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1 Course Overview

This is PhD-level field course focusing on the intersection o Environmental/Energy Economics and Development Economics. While traditionally treated as separate fields, prominent research in applied microeconomics is increasingly bringing them together. This course explores the inherent underlying connections between environment and development, while offering an in-depth survey of the current research landscape. Throughout the semester, we will alternate between two perspectives: (i) the development economist focusing on the relationships between growth, poverty, public good provision, and environmental externalities; and (ii) the environmental economist focusing on valuing and correcting externalities in low- and middle-income countries.

I have organized the course around practical applications of empirical research methods. We will dissect research papers that use a wide range of research designs, identification strategies, and estimation techniques. By actively engaging in this process, each of you will hopefully start putting the pieces together as applied microeconomic researchers—by understanding (i) what makes a successful research question, and (ii) what passes muster for credible empirics in 2022.

2 Prerequisites

This course assumes you have completed first-year PhD courses in microeconomic theory (ECON603 and ECON604, or equivalent) and applied econometrics (AREC623 and AREC624, or equivalent). Previous coursework in either environmental or development economics is not necessary. If you are unsure whether you are sufficiently prepared for this course, please email me.

3 Logistics

3.1 Class Meetings

This course will meet **in person**, **Mondays and Wednesdays, 9:30–10:45am Eastern Time**, in **Symons Hall 2200B**. We will rely heavily on interactive group discussions, and I expect you to come to each class having already engaged with that day's assigned reading(s). The more effort you put into this course, the more you will (hopefully) get out of it!

3.2 Attendance and Meeting in Person

For this semester to be a success, we must respect each other's physical health. Please do not come to class if you are feeling sick, as COVID still lurks among us. I expect you to attend class if healthy.

We must also respect our collective mental health, as we are still living through challenging times. Remember to check in with yourselves, and with your classmates. I am happy to discuss any questions or concerns you might have, so that we may establish a safe, welcoming learning environment.

While I hope to meet in person throughout the semester, the occasional negative childcare shock may make it difficult for me to come to campus. If this happens, I may switch from in-person to Zoom on an ad hoc basis. I appreciate your flexibility in advance.

3.3 Office Hours

My office hours are **Mondays 11:00am–12:00pm** and **1:30pm–2:30pm**, and I encourage you to sign up on my website: `http://www.louispreonas.com/office-hours`. While this time slot will double as my advising office hours for PhD students outside of this course, AREC845 students will get priority in the event of congestion. I will be in my office most Monday afternoons, and will accommodate both Zoom and in-person meetings (whichever is easier for you).

3.4 Course Website

I will upload all course materials to ELMS, including readings, assignments, and any supplementary notes. All readings are also available online. You will submit assignments by uploading to ELMS.

3.5 Email

Please email me at lpreonas@umd.edu with any questions, concerns, or ideas you might have. Emailing me directly is safer than messaging me through ELMS, since ELMS-forwarded emails bypass my primary inbox. Do not be shy about sending follow-up emails if I forget to reply.

3.6 Campus Policies

It is our joint responsibility to understand and abide by the University of Maryland's policies related to all courses which include topics such as Academic Integrity, student and instructor conduct, accessibility and accommodations, attendance and excused absences, grades and appeals, and copyright and intellectual property. You can find a full list of these policies at `https://gradschool.umd.edu/course-related-policies`. I am happy to discuss them further if you have questions.

4 Course Structure

The grading breakdown for the course is:

In-class presentations	20%
Problem sets	40%
Referee report	10%
Research proposal	20%
Summaries of department seminars	5%
Participation	5%

4.1 In-class Presentations (20%)

I have set aside 8 class periods for student presentations (see course schedule and reading list below). Two papers are assigned for most presentation days (30–40 minutes each), except for joint presentations of some complex structural papers.

Throughout the semester, each of you will be responsible for presenting **twice**. Presenters may role play as if they are the paper's author (e.g., "This is what we do, and here is why our work is important."), while the rest of us act as skeptical discussants (e.g., "Do we really believe that your instrument is valid?"). Alternatively, presenters may decide that they don't want to have to defend the paper. The goal is to stimulate a discussion, however you see fit!

I will post a schedule of presenters on ELMS, which will assign property rights to presentation slots (and papers). I encourage you to make Pareto-improving trades; please email me requesting any date swaps, with all parties CCed.

4.2 Problem Sets (40%)

There will be 5 problem sets requiring a combination of writing, economic theory, and econometric analysis (in Stata or `R`). The goal will be to force you to directly apply the methods we cover in class, while also learning a few tricks of the trade. You may work in small groups, however each student must type out their own original submission and code. I will drop your lowest problem set grade, meaning that your top 4 problem sets will be worth 10% each. (You must still attempt all 5 problem sets).

4.3 Referee Report (10%)

You will be required to write a referee report on **Katovich and Moffette (2023)**, a current environment/development job market paper. Referee reports are essential to the peer review process, and writing them (while often tedious and unpleasant) is the best way to truly understand the nuts and bolts of a paper. Your report is due on **April 5**, but I encourage you not to procrastinate (ha). It is a solo assignment. I have posted guidelines for how to write a successful referee report (including a letter to the editor) on ELMS.

4.4 Research Proposal (20%)

As PhD students, you are expected to become expert consumers and **producers** of research. To this end, you will be required to develop a written proposal for a research project in the environment/development space. This proposal must be **original** and **unique to this course** (i.e. no double-dipping with your qualifying paper). Throughout the semester, I will provide a series of small deadlines that will culminate in a written proposal to submit at the end of the semester. Please see details that I've posted on ELMS. During the last week of classes, you will each give a short (20-minute) presentation of your research proposal to the class, followed by 10 minutes of group discussion.

4.5 Summaries of Department Seminars (5%)

AREC department seminars occur weekly on Wednesdays from 12:00–1:30pm, and the current schedule is posted here: https://www.arec.umd.edu/seminars. They are an excellent opportunity for students to (i) engage with cutting edge research in AREC-related fields; (ii) learn how to structure and prepare an economics talk; and (iii) apply the microeconomics toolkit on the fly. I strongly encourage you attend all AREC department seminars throughout your time in the graduate program.

During your current semester in this course, you are required to attend at least 4 department seminars. Within 24 hours of each of these seminars, you will be required to write and submit 1 healthy paragraph describing the following aspects of the paper presented:

1. its main research question(s)
2. its theoretical/empirical approach
3. its main conclusions
4. its strengths and weaknesses

4.6 Participation (5%)

Many of us may not have recovered our pre-pandemic levels of productivity, focus, and physical/mental/emotional health. I do not want this course to compound the other stresses in your lives. These participation points are here to incentivize active, good-faith engagement in the course, which I will especially appreciate (and reward in kind) as we navigate the ongoing post-COVID renormalization process.

5 Course Schedule

I've organized the course as a journey through empirical research methods from elegant (i.e. RCTs) to complex (i.e. dynamic discrete choice estimation). For 8 class periods, we will devote the entire 75-minute period to student presentations. Class is tentatively canceled for April 3 and April 8, pending finalization of some planned travel. The last week of classes is reserved for presentations of research proposals.

Date	**Module**	**Papers covered in class***
W Jan 24	1 – Overview	Greenstone & Jack (2015); Jayachandran (2022)
M Jan 29	2 – RCTs	Lee, Miguel & Wolfram (2020)
W Jan 31	2 – RCTs	Duflo et al. (2013)
M Feb 5	2 – RCTs	Gonzalez-Lira & Mobarak (2022)
W Feb 7	3 – Spillovers	Miguel & Kremer (2004)
M Feb 12 Ⓢ	3 – Spillovers	Jayachandran et al. (2017); Jack et al. (2023)
W Feb 14	4 – RD Designs	Sharan & Kumar (2021); Ebenstein et al. (2017)
M Feb 19 Ⓢ	4 – RD Designs	He, Wang, & Zhang (2020); Mahadevan (2023)
W Feb 21	5 – Diff & Diff	Jensen (2007)
M Feb 26 Ⓢ	5 – Diff & Diff	Chimeli & Soares (2017); Wang & Wang (2021)
W Feb 28	Class canceled	
M Mar 4	5 – Diff & Diff	Somanathan et al. (2022); Carleton et al. (2020)
W Mar 6	6 – Matching	Sekhri (2011); Blakeslee, Fishman & Srinivasan (2020)
M Mar 11 Ⓢ	6 – Matching	Alix-Garcia et al. (2015); Cui et al. (2023)
W Mar 13	7 – Event Study Designs	Davis (2008); Ito & Zhang (2023)
M Mar 18	Spring Break, no class	
W Mar 20	Spring Break, no class	
M Mar 25 Ⓢ	7 – Event Study Designs	He, Liu, & Salvo (2019); Barwick et al. (2019)
W Mar 27	8 – Valuation	Kremer et al. (2011)
M Apr 1	8 – Valuation	Bhattacharya et al. (2007); Leon & Miguel (2017)
W Apr 3	9 – Demand Estimation	McRae (2015)
M Apr 8	Class canceled	
W Apr 10	9 – Demand Estimation	Ito & Zhang (2020)
M Apr 15 Ⓢ	9 – Demand Estimation	Burgess et al. (2023); Kreindler (2023)
W Apr 17	10 – Supply-side Estimation	Ryan & Sudarshan (2022)
M Apr 22 Ⓢ	10 – Supply-side Estimation	Ryan (2022)
W Apr 24	11 – Dynamic Discrete choice	Oliva (2015)
M Apr 29	11 – Dynamic Discrete Choice	Duflo et al. (2018)
W May 1 Ⓢ	11 – Dynamic Discrete Choice	Hsiao (2022)
M May 6	Research proposal presentations	
W May 8	Research proposal presentations	

Ⓢ student presentations * subject to change

6 Reading List

I've grouped papers by module, corresponding to the sequence of empirical methods we will cover throughout the semester. All readings are available in PDF format on ELMS. This reading list may evolve. I will alert you of any changes as I make them.

Key:

★	Required reading for class
Ⓢ	Paper for student presentation
¶	Paper for problem set
ℜ	Paper for referee report assignment
–	Additional readings (not required, but good to know, and I might still cover them)

Module 1: Overview of Environment and Development

★ Michael Greenstone and B. Kelsey Jack. 2015. "Envirodevonomics: A Research Agenda for an Emerging Field." *Journal of Economic Literature* 53 (1): 5–42. **(Sections 1–2)**

★ Seema Jayachandran. 2022. "How Economic Development Influences the Environment." *Annual Review of Economics* 14:229–252.

– Rachel Glennerster and Seema Jayachandran. 2023. "Think Globally, Act Globally: Opportunities to Mitigate Greenhouse Gas Emissions in Low- and Middle-Income Countries." *Journal of Economic Perspectives* 37 (3): 111–136.

– Robin Burgess, Michael Greenstone, Nicholas Ryan, and Anant Sudarshan. 2020. "The Consequences of Treating Electricity as a Right." *Journal of Economic Perspectives* 34 (1): 145–169.

– B. Kelsey Jack. 2017. "Environmental Economics in Developing Countries: An Introduction to the Special Issue." *Journal of Environmental Economics and Management* 86:1–7.

– Anthony J. Venables. 2016. "Using Natural Resources for Development: Why Has It Proven So Difficult?" *Journal of Economic Perspectives* 30 (1): 161–184.

– Catherine Wolfram, Orie Shelef, and Paul Gertler. 2012. "How Will Energy Demand Develop in the Developing World?" *Journal of Economic Perspectives* 26 (1): 119–138.

– Partha Dasgupta. 2010. "The Place of Nature in Economic Development." In *Handbook of Development Economics,* 5:4977–5046. Elsevier.

Module 2: Randomized Experiments

★ Kenneth Lee, Edward Miguel, and Catherine Wolfram. 2020. "Experimental Evidence on the Economics of Rural Electrification." *Journal of Political Economy* 128 (4): 1523–1565.

★ Esther Duflo, Michael Greenstone, Rohini Pande, and Nicholas Ryan. 2013. "Truth-telling by Third-party Auditors and the Response of Polluting Firms: Experimental Evidence from India." *Quarterly Journal of Economics* 128 (4): 1499–1545.

★ Andres Gonzalez-Lira and Ahmed Mushfiq Mobarak. 2022. "Slippery Fish: Enforcing Regulation whe Agents Learn and Adapt."

¶ B. Kelsey Jack. 2013. "Private Information and the Allocation of Land Use Subsidies in Malawi." *American Economic Journal: Applied Economics* 5 (3): 113–135.

– Mark Buntaine, Michael Greenstone, Guojun He, Mengdi Liu, Shaoda Wang, and Bing Zhang. 2023. "Does the Squeaky Wheel Get More Grease? The Direct and Indirect Effects of Citizen Participation on Environmental Governance in China." *American Economic Review:* forthcoming.

– Aidan Coville, Sebastian Galiani, Paul Gertler, and Susumu Yoshida. 2023. "Financing Municipal Water and Sanitation Services in Nairobi's Informal Settlements." *Review of Economics and Statistics:* forthcoming.

– Susanna B. Berkouwer and Joshua T. Dean. 2022. "Credit and Attention in the Adoption of Profitable Energy Efficient Technologies in Kenya." *American Economic Review* 112 (10): 3291–3330.

– Kelsey Jack and Grant Smith. 2020. "Charging Ahead: Prepaid Metering, Electricity Use, and Utility Revenue." *American Economic Journal: Applied Economics* 12 (2): 134–168.

– Chantal Toledo. 2016. "Do Environmental Messages Work on the Poor? Experimental Evidence from Brazilian Favelas." *Journal of the Association of Environmental and Resource Economists* 3 (1): 37–83.

– Rema Hanna, Esther Duflo, and Michael Greenstone. 2016. "Up in Smoke: The Influence of Household Behavior on the Long-Run Impact of Improved Cooking Stoves." *American Economic Journal: Economic Policy* 8 (1): 80–114.

– Niklas Bengtsson. 2015. "Efficient Informal Trade: Theory and Experimental Evidence from the Cape Town Taxi Market." *Journal of Development Economics* 115:85–98.

– Jyotsna Jalan and E. Somanathan. 2008. "The Importance of Being Informed: Experimental Evidence on Demand for Environmental Quality." *Journal of Development Economics* 87 (1): 14–28.

Module 3: Spillovers in Randomized Experiments

★ Edward Miguel and Michael Kremer. 2004. "Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities." *Econometrica* 72 (1): 159–217.

Ⓢ ★ Seema Jayachandran, Joost de Laat, Eric F. Lambin, Charlotte Y. Stanton, Robin Audy, and Nancy E. Thomas. 2017. "Cash for Carbon: A Randomized Trial of Payments for Ecosystem Services to Reduce Deforestation." *Science* 357 (6348): 267–273.

¶ Ⓢ ★ B. Kelsey Jack, Seema Jayachandran, Namrata Kala, and Rohini Pande. 2023. "Money (Not) to Burn: Payments for Ecosystem Services to Reduce Crop Residue Burning." *American Economic Review: Insights:* forthcoming.

– B. Kelsey Jack, Seema Jayachandran, Flavio Malagutti, and Sarojini Rao. 2023. "Environmental Externalities and Free-riding in the Household."

– Joan Hamory, Edward Miguel, Michael Walker, Michael Kremer, and Sarah Baird. 2021. "Twenty-Year Economic Impacts of Deworming." *Proceedings of the National Academy of Sciences* 118 (14): e2023185118.

– B. Kelsey Jack and Seema Jayachandran. 2019. "Self-Selection into Payments for Ecosystem Services Programs." *Proceedings of the National Academy of Sciences* 116 (12): 5326–5333.

– Sarah Baird, Joan Hamory Hicks, Michael Kremer, and Edward Miguel. 2016. "Worms at Work: Long-run Impacts of a Child Health Investment." *Quarterly Journal of Economics* 131 (4): 1637–1680.

– B. Kelsey Jack and María P. Recalde. 2015. "Leadership and the Voluntary Provision of Public Goods: Field Evidence from Bolivia." *Journal of Public Economics* 122:80–93.

Module 4: Regression Discontinuity Designs

★ M. R. Sharan and Chinmaya Kumar. 2021. "Something to Complain About: How Minority Representatives Overcome Ethnic Differences."

★ Avraham Ebenstein, Maoyong Fan, Michael Greenstone, Guojun He, and Maigeng Zhou. 2017. "New Evidence on the Impact of Sustained Exposure to Air Pollution on Life Expectancy from China's Huai River Policy." *Proceedings of the National Academy of Sciences* 114 (39): 10384–10389.

Ⓢ ★ Guojun He, Shaoda Wang, and Bing Zhang. 2020. "Watering Down Environmental Regulation in China." *Quarterly Journal of Economics* 135 (4): 2135–2185.

Ⓢ ★ Meera Mahadevan. 2023. "The Price of Power: Costs of Political Corruption in Indian Electricity."

¶ Fiona Burlig and Louis Preonas. 2022. "Out of the Darkness and Into the Light? Development Effects of Rural Electrification." *Journal of Political Economy:* forthcoming.

– Robin Burgess, Francisco Costa, and Benjamin A. Olken. 2023. "National Borders and the Conservation of Nature."

Module 5: Difference in Differences

★ Robert Jensen. 2007. "The Digital Provide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector." *Quarterly Journal of Economics* 122 (3): 879–924.

Ⓢ ★ Ariaster B. Chimeli and Rodrigo R. Soares. 2017. "The Use of Violence in Illegal Markets: Evidence from Mahogany Trade in the Brazilian Amazon." *American Economic Journal: Applied Economics* 9 (4): 30–57.

Ⓢ ★ Shaoda Wang and Zenan Wang. 2021. "The Environmental and Economic Consequences of Internalizing Border Spillovers."

★ E. Somanathan, Rohini Somanathan, Anant Sudarshan, and Meenu Tewari. 2021. "The Impact of Temperature on Productivity and Labor Supply: Evidence from Indian Manufacturing." *Journal of Political Economy* 129 (6): 1797–1827.

★ Tamma Carleton et al. 2022. "Valuing the Global Mortality Consequences of Climate Change Accounting for Adaptation Costs and Benefits." *Quarterly Journal of Economics* 137 (4): 2037–2105.

¶ Molly Lipscomb, A. Mushfiq Mobarak, and Tania Barham. 2013. "Development Effects of Electrification: Evidence from the Topographic Placement of Hydropower Plants in Brazil." *American Economic Journal: Applied Economics* 5 (2): 200–231.

– Clare Balboni, Robin Burgess, and Benjamin A. Olken. 2023. "The Origins and Control of Forest Fires in the Tropics."

– Shinsuke Tanaka, Kensuke Teshima, and Eric Verhoogen. 2022. "North-South Displacement Effects of Environmental Regulation: The Case of Battery Recycling." *American Economic Review: Insights* 4 (3): 271–288.

– Shuai Chen, Paulina Oliva, and Peng Zhang. 2022. "The Effect of Air Pollution on Migration: Evidence from China." *Journal of Development Economics* 156:102833.

– Fernando M. Aragón, Francisco Oteiza, and Juan Pablo Rud. 2021. "Climate Change and Agriculture: Subsistence Farmers' Response to Extreme Heat." *American Economic Journal: Economic Policy* 13 (1): 1–35.

– Teevrat Garg, Maulik Jagnani, and Vis Taraz. 2020. "Temperature and Human Capital in India." *Journal of the Association of Environmental and Resource Economists* 7 (6): 1113–1150.

– Pasita Chaijaroen. 2019. "Long-lasting Income Shocks and Adaptations: Evidence from Coral Bleaching in Indonesia." *Journal of Development Economics* 136:119–136.

– Tom Y. Chang, Joshua Graff Zivin, Tal Gross, and Matthew Neidell. 2019. "The Effect of Pollution on Worker Productivity: Evidence from Call Center Workers in China." *American Economic Journal: Applied Economics* 11 (1): 151–172.

– Thanyaporn Chankrajang. 2019. "State-community Property-rights Sharing in Forests and Its Contributions to Environmental Outcomes: Evidence from Thailand's Community Forestry." *Journal of Development Economics* 138:261–273.

– Teevrat Garg, Stuart E. Hamilton, Jacob P. Hochard, Evan Plous Kresch, and John Talbot. 2018. "(Not So) Gently Down the Stream: River Pollution and Health in Indonesia." *Journal of Environmental Economics and Management* 92:35–53.

– Molly Lipscomb and Ahmed Mushfiq Mobarak. 2017. "Decentralization and Pollution Spillovers: Evidence from the Re-drawing of County Borders in Brazil." *Review of Economic Studies* 84 (1): 464–502.

– Nicolas Berman, Mathieu Couttenier, Dominic Rohner, and Mathias Thoenig. 2017. "This Mine is Mine! How Minerals Fuel Conflicts in Africa." *American Economic Review* 107 (6): 1564–1610.

– Tamma A. Carleton. 2017. "Crop-damaging Temperatures Increase Suicide Rates in India." *Proceedings of the National Academy of Sciences* 114 (33): 8746–8751.

– Paul J. Gertler, Orie Shelef, Catherine D. Wolfram, and Alan Fuchs. 2016. "The Demand for Energy-Using Assets among the World's Rising Middle Classes." *American Economic Review* 106 (6): 1366–1401.

– Rema Hanna and Paulina Oliva. 2015. "The Effect of Pollution on Labor Supply: Evidence from a Natural Experiment in Mexico City." *Journal of Public Economics* 122:68–79.

– Matthew E. Kahn, Pei Li, and Daxuan Zhao. 2015. "Water Pollution Progress at Borders: The Role of Changes in China's Political Promotion Incentives." *American Economic Journal: Economic Policy* 7 (4): 223–242.

– Sheetal Sekhri. 2014. "Wells, Water, and Welfare: The Impact of Access to Groundwater on Rural Poverty and Conflict." *American Economic Journal: Applied Economics* 6 (3): 76–102.

– Robin Burgess, Matthew Hansen, Benjamin A. Olken, Peter Potapov, and Stefanie Sieber. 2012. "The Political Economy of Deforestation in the Tropics." *Quarterly Journal of Economics* 127 (4): 1707–1754.

– Seema Jayachandran. 2009. "Air Quality and Early-Life Mortality: Evidence from Indonesia's Wildfires." *Journal of Human Resources* 44 (4): 916–954.

Module 6: Matching

★ Sheetal Sekhri. 2011. "Public Provision and Protection of Natural Resources: Groundwater Irrigation in Rural India." *American Economic Journal: Applied Economics* 3 (4): 29–55.

★ David Blakeslee, Ram Fishman, and Veena Srinivasan. 2020. "Way Down in the Hole: Adaptation to Long-Term Water Loss in Rural India." *American Economic Review* 110 (1): 200–224.

Ⓢ ★ Jennifer M. Alix-Garcia, Katharine R. E. Sims, and Patricia Yañez-Pagans. 2015. "Only One Tree from Each Seed? Environmental Effectiveness and Poverty Alleviation in Mexico's Payments for Ecosystem Services Program." *American Economic Journal: Economic Policy* 7 (4): 1–40.

Ⓢ ★ Jingbo Cui, Chunhua Wang, Zhenxuan Wang, Junjie Zhang, and Yang Zheng. 2023. "Carbon Leakage within Firm Ownership Networks: Evidence from China's Regional Carbon Market Pilots."

– Allen Blackman and Laura Villalobos. 2020. "Use Forests or Lose Them? Regulated Timber Extraction and Tree Cover Loss in Mexico." *Journal of the Association of Environmental and Resource Economists:* 710837.

– Lucas W. Davis, Alan Fuchs, and Paul Gertler. 2014. "Cash for Coolers: Evaluating a Large-Scale Appliance Replacement Program in Mexico." *American Economic Journal: Economic Policy* 6 (4): 207–238.

Module 7: Event Study Designs

★ Lucas W. Davis. 2008. "The Effect of Driving Restrictions on Air Quality in Mexico City." *Journal of Political Economy* 116 (1): 38–81.

★ Koichiro Ito and Shuang Zhang. 2023. "Do Consumers Distinguish Fixed Cost from Variable Cost? "Schmeduling" in Two-Part Tariffs in Energy."

Ⓢ ★ Jiaxiu He, Haoming Liu, and Alberto Salvo. 2019. "Severe Air Pollution and Labor Productivity: Evidence from Industrial Towns in China." *American Economic Journal: Applied Economics* 11 (1): 173–201.

Ⓢ ★ Panle Jia Barwick, Shanjun Li, Liguo Lin, and Eric Zou. 2022. "From Fog to Smog: The Value of Pollution Information." *American Economic Review.*

ℜ Erik Katovich and Fanny Moffette. 2023. "Does Local Politics Drive Tropical Land-Use Change? Property-Level Evidence from the Amazon."

– James Fenske, Muhammad Haseeb, and Kala Namrata. 2023. "How Rules and Compliance Impact Organizational Outcomes: Evidence from Delegation in Environmental Regulation."

– Clare Balboni, Johannes Boehm, and Mazhar Waseem. 2023. "Firm Adaptation in Production Networks: Evidence from Extreme Weather Events in Pakistan."

– Raahil Madhok. 2023. "Infrastructure, Institutions, and the Conservation of Biodiversity in India."

– Sonia R. Bhalotra, Alberto Diaz-Cayeros, Grant Miller, Alfonso Miranda, and Atheendar S. Venkataramani. 2021. "Urban Water Disinfection and Mortality Decline in Lower-Income Countries." *American Economic Journal: Economic Policy* 13 (4): 490–520

– Ryan Abman and Clark Lundberg. 2020. "Does Free Trade Increase Deforestation? The Effects of Regional Trade Agreements." *Journal of the Association of Environmental and Resource Economists* 7 (1): 35–72.

– Geoffrey Barrows, Teevrat Garg, and Akshaya Jha. 2019. "The Health Costs of Coal-Fired Power Plants in India."

– Michael Greenstone and Rema Hanna. 2014. "Environmental Regulations, Air and Water Pollution, and Infant Mortality in India." *American Economic Review* 104 (10): 3038–3072.

Module 8: Valuation

★ Michael Kremer, Jessica Leino, Edward Miguel, and Alix Peterson Zwane. 2011. "Spring Cleaning: Rural Water Impacts, Valuation, and Property Rights Institutions." *Quarterly Journal of Economics* 126 (1): 145–205.

★ Soma Bhattacharya, Anna Alberini, and Maureen L. Cropper. 2007. "The Value of Mortality Risk Reductions in Delhi, India." *Journal of Risk and Uncertainty* 34 (1): 21–47.

★ Gianmarco León and Edward Miguel. 2017. "Risky Transportation Choices and the Value of a Statistical Life." *American Economic Journal: Applied Economics* 9 (1): 202–228.

– Susanna B. Berkouwer, Pierre E. Biscaye, Steven Puller, and Catherine D. Wolfram. 2022. "Disbursing Emergency Relief through Utilities: Evidence from Ghana." *Journal of Development Economics* 156:102826.

– A. Mushfiq Mobarak, Puneet Dwivedi, Robert Bailis, Lynn Hildemann, and Grant Miller. 2012. "Low Demand for Nontraditional Cookstove Technologies." *Proceedings of the National Academy of Sciences* 109 (27): 10815–10820.

Module 9: Structural Demand Estimation

¶ ★ Shaun McRae. 2015. "Infrastructure Quality and the Subsidy Trap." *American Economic Review* 105 (1): 35–66.

★ Koichiro Ito and Shuang Zhang. 2020. "Willingness to Pay for Clean Air: Evidence from Air Purifier Markets in China." *Journal of Political Economy* 128 (5): 1627–1672.

Ⓢ ★ Robin Burgess, Michael Greenstone, Nicholas Ryan, and Anant Sudarshan. 2023. "Electricity Demand and Supply on the Global Electrification Frontier."

Ⓢ ★ Gabriel E. Kreindler. 2023. "Peak-Hour Road Congestion Pricing: Experimental Evidence and Equilibrium Implications." *Econometrica:* forthcoming.

– Dev Patel. 2024. "Learning About a Warming World: Attention and Adaptation in Agriculture."

– Raymond P. Guiteras, David I. Levine, Stephen P. Luby, Thomas H. Polley, Kaniz Khatun-e-Jannat, and Leanne Unicomb. 2016. "Disgust, Shame, and Soapy Water: Tests of Novel Interventions to Promote Safe Water and Hygiene." *Journal of the Association of Environmental and Resource Economists* 3 (2): 321–359.

– Andrea Szabó. 2015. "The Value of Free Water: Analyzing South Africa's Free Basic Water Policy." *Econometrica* 83 (5): 1913–1961.

Module 10: Structural Supply-side Estimation

★ Nicholas Ryan and Anant Sudarshan. 2022. "Rationing the Commons." *Journal of Political Economy* 130 (1): 210–257.

Ⓢ ★ Nicholas Ryan. 2022. "Holding Up Green Energy: Counterparty Risk in the Indian Solar Power Market." *Econometrica:* forthcoming.

– Marcos Barrozo. 2023. "Market Power and Carbon Emissions in the Amazon."

– Nicholas Ryan. 2021. "The Competitive Effects of Transmission Infrastructure in the Indian Electricity Market." *American Economic Journal: Microeconomics* 13 (2): 202–242.

– Nicholas Ryan. 2020. "Contract Enforcement and Productive Efficiency: Evidence From the Bidding and Renegotiation of Power Contracts in India." *Econometrica* 88 (2): 383–424.

– Nicholas Ryan. 2018. "Energy Productivity and Energy Demand: Experimental Evidence from Indian Manufacturing Plants."

Module 11: Dynamic Discrete Choice

★ Paulina Oliva. 2015. "Environmental Regulations and Corruption: Automobile Emissions in Mexico City." *Journal of Political Economy* 123 (3): 686–724.

★ Esther Duflo, Michael Greenstone, Rohini Pande, and Nicholas Ryan. 2018. "The Value of Regulatory Discretion: Estimates From Environmental Inspections in India." *Econometrica* 86 (6): 2123–2160.

Ⓢ ★ Allan Hsiao. 2022. "Coordination and Commitment in International Climate Action: Evidence from Palm Oil."

– Allan Hsiao. 2023. "Sea Level Rise and Urban Adaptation in Jakarta."

– Rafael Araujo, Francisco Costa, and Marcelo Sant'Anna. 2022. "Efficient Forestation in the Brazilian Amazon."

– Paulina Oliva, B. Kelsey Jack, Samuel Bell, Elizabeth Mettetal, and Christopher Severen. 2020. "Technology Adoption under Uncertainty: Take-Up and Subsequent Investment in Zambia." *Review of Economics and Statistics* 102 (3): 617–632

7 Methodological References

We'll be using the Environment and Development literature to engage with research methods from an applied, practical perspective. The following papers provide more formal guidance on each research design, including several recent methodological advances. This list is far from exhaustive, but should serve as a great jumping off point. I've uploaded all PDFs to ELMS. I will reference several of them throughout the semester, though they are not required reading.

Causal Estimation and Program Evaluation

- Alberto Abadie and Matias D. Cattaneo. 2018. "Econometric Methods for Program Evaluation." *Annual Review of Economics* 10 (1): 465–503.
- Susan Athey and Guido W. Imbens. 2017b. "The State of Applied Econometrics: Causality and Policy Evaluation." *Journal of Economic Perspectives* 31 (2): 3–32.

Randomized Experiments

- Esther Duflo, Rachel Glennerster, and Michael Kremer. 2008. "Using Randomization in Development Economics Research: A Toolkit." In *Handbook of Development Economics,* 4:3895–3962. Elsevier.
- David Card, Stefano DellaVigna, and Ulrike Malmendier. 2011. "The Role of Theory in Field Experiments." *Journal of Economic Perspectives* 25 (3): 39–62.
- S. Athey and G.W. Imbens. 2017a. "The Econometrics of Randomized Experiments." In *Handbook of Economic Field Experiments,* 1:73–140. Elsevier.
- Sarah Baird, J. Aislinn Bohren, Craig McIntosh, and Berk Özler. 2018. "Optimal Design of Experiments in the Presence of Interference." *Review of Economics and Statistics* 100 (5): 844–860.
- Fiona Burlig, Louis Preonas, and Matt Woerman. 2020. "Panel Data and Experimental Design." *Journal of Development Economics* 144:102458.

Regression Discontinuity Designs

- Justin McCrary. 2008. "Manipulation of the Running Variable in the Regression Discontinuity Design: A Density Test." *Journal of Econometrics* 142 (2): 698–714.
- David S. Lee and Thomas Lemieux. 2010. "Regression Discontinuity Designs in Economics." *Journal of Economic Literature* 48 (2): 281–355.
- Sebastian Calonico, Matias D. Cattaneo, and Rocio Titiunik. 2014. "Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs." *Econometrica* 82 (6): 2295–2326.

- Sebastian Calonico, Matias D. Cattaneo, and Rocío Titiunik. 2015. "Optimal Data-Driven Regression Discontinuity Plots." *Journal of the American Statistical Association* 110 (512): 1753–1769.
- Sebastian Calonico, Matias D. Cattaneo, Max H. Farrell, and Rocío Titiunik. 2019. "Regression Discontinuity Designs Using Covariates." *Review of Economics and Statistics* 101 (3): 442–451.

Difference in Differences and Panel Fixed Effects

- Marianne Bertrand, Esther Duflo, and Sendhil Mullainathan. 2004. "How Much Should We Trust Difference-in-differences Estimates?" *Quarterly Journal of Economics* 119 (1): 249–275.
- Pedro H. C. Sant'Anna and Jun Zhao. 2020. "Doubly Robust Difference-in-Difference Estimators." *Journal of Econometrics* 219 (1): 101–122.
- Clément de Chaisemartin and Xavier D'Haultfoeuille. 2020. "Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects." *American Economic Review* 110 (9): 2964–2996.
- Andrew Goodman-Bacon. 2021. "Difference-in-Differences with Variation in Treatment Timing." *Journal of Econometrics* 225 (2): 254–277.
- Jeffrey M. Wooldridge. 2021. "Two-Way Fixed Effects, the Two-Way Mundlak Regression, and Difference-in-Differences Estimators."
- Jonathan Roth. 2022. "Pretest with Caution: Event-Study Estimates after Testing for Parallel Trends." *American Economic Review: Insights* 4 (3): 305–322.
- Clément de Chaisemartin and Xavier D'Haultfoeuille. 2023. "Differences-in-Differences Estimators of Intertemporal Treatment Effects." *Review of Economics and Statistics:* forthcoming.
- Jonathan Roth, Pedro H. C. Sant'Anna, Alyssa Bilinski, and John Poe. 2023. "What's Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature." *Journal of Econometrics* 235 (2): 2218–2244.

Instrumental Variables

- Joshua D. Angrist and Alan B. Krueger. 2001. "Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments." *Journal of Economic Perspectives* 15 (4): 69–85.
- Timothy G. Conley, Christian B. Hansen, and Peter E. Rossi. 2012. "Plausibly Exogenous." *Review of Economics and Statistics* 94 (1): 260–272.
- Alexandre Belloni, Victor Chernozhukov, and Christian Hansen. 2014. "High-Dimensional Methods and Inference on Structural and Treatment Effects." *Journal of Economic Perspectives* 28 (2): 29–50.

- Kirill Borusyak, Peter Hull, and Xavier Jaravel. 2022. "Quasi-Experimental Shift-Share Research Designs." *Review of Economic Studies* 89 (1): 181–213.

Matching

- James J. Heckman, Hidehiko Ichimura, and Petra Todd. 1998. "Matching as nn Econometric Evaluation Estimator." *Review of Economic Studies* 65 (2): 261–294.
- Alberto Abadie and Guido W. Imbens. 2016. "Matching on the Estimated Propensity Score." *Econometrica* 84 (2): 781–807.

Event Study Designs

- Catherine Hausman and David S Rapson. 2018. "Regression Discontinuity in Time: Considerations for Empirical Applications." *Annual Review of Resource Economics* 10:533–552.
- Simon Freyaldenhoven, Christian Hansen, and Jesse M. Shapiro. 2019. "Pre-Event Trends in the Panel Event-Study Design." *American Economic Review* 109 (9): 3307–3338.

Discrete Choice and Structural Estimation

- Kenneth Train. 2009. *Discrete Choice Methods with Simulation.* Cambridge University Press. Chapters 2, 3, 6, 13. Available here: https://eml.berkeley.edu/books/choice2.html
- Aviv Nevo. 2000. "A Practitioner's Guide to Estimation of Random-Coefficients Logit Models of Demand." *Journal of Economics & Management Strategy* 9 (4): 513–548.
- Hamish Low and Costas Meghir. 2017. "The Use of Structural Models in Econometrics." *Journal of Economic Perspectives* 31 (2): 33–58.

Dynamic Discrete Choice Estimation

- John Rust. 1987. "Optimal Replacement of GMC Bus Engines: An Empirical Model of Harold Zurcher." *Econometrica* 55 (5): 999.
- Peter Arcidiacono and Paul B. Ellickson. 2011. "Practical Methods for Estimation of Dynamic Discrete Choice Models." *Annual Review of Economics* 3 (1): 363–394.
- Myrto Kalouptsidi, Paul T. Scott, and Eduardo Souza-Rodrigues. 2021. "Linear IV regression estimators for structural dynamic discrete choice models." *Journal of Econometrics* 222 (1): 778–804.