

SYLLABUS

PPHA 44320: Energy and Environmental Economics I

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Office Hours: by appointment

Fall 2024
Course meetings: TTh 2:00 – 3:20
Location: Keller 0010

PPHA 44320 is the first course in the PhD energy and environmental economics sequence. In my course, we will emphasize the fundamental economic aspects of resource production and problems associated with externalities and common property. Most topics will be theoretical in nature, but we will spend considerable time studying applications that have an empirical component.

Course objectives: The course has four complementary objectives: (1) provide a foundation in concepts like Hotelling's Rule and Pigouvian taxation that are a prerequisite for understanding modern environmental and resource economics; (2) build comprehension of frontier research that grapples with these concepts; (3) develop proficiency with theoretical, computational, and empirical tools that will be valuable for future self-directed research; and (4) gain experience in reading, presenting, and discussing modern research in energy and environmental economics.

Prerequisites: Successful completion of the PhD micro theory sequence (or equivalent) is a prerequisite for this course. You should also either have or quickly develop a facility with constrained optimization and optimal control theory / dynamic programming. See the Baumol chapter and Olson handouts listed in the week 1 readings, as well as chapter 7 of Hanley, Shogren, and White. The Léonard and van Long text is an excellent resource. You should also have a background in statistics and regression analysis.

Format: Each week will typically involve a combination of pre-recorded lectures and in-person class meetings.

I will generally use the pre-recorded lectures to present content that is relatively technical in nature. These pre-recordings allow us to use our in-class time for discussion rather than have me lecture at you. The pre-recorded modules will include short (non-credit) quizzes that will let you self-assess your comprehension of the material. Each module will also be associated with a discussion forum that you can use to ask questions. Depending on the nature of each question, I might answer it online or save it for discussion during our class meetings. Class meetings will be used primarily for answering questions about recorded material, some additional lecture, discussion of economic concepts related to the lectures, and student presentation and discussion of selected papers.

Assignments

With the above course objectives in mind, the course has the following required assignments: (1) in-class presentations and discussions of papers; (2) two problem sets that stress analytical theory; (3) a computational assignment; and (4) a final exam.

The **problem sets** will give you practice in setting up models of natural resource extraction and pollution control, and using those models to answer questions. They are due on October 25 and December 4. The computational assignment asks you to set up and solve dynamic resource extraction problems on the computer and is due on November 8. For the problem sets and computational assignment, feel free to work with others in the class, though what you turn in must be written / coded up individually.

The **final exam** will be take-home. It will be open book / notes / computer, but you are not permitted to consult with any other person (whether they are in the class or not). I will announce the date window during which the final exam may be taken later in the course, but you can expect it to roughly correspond to the week after our final class session.

The **student presentations** merit more discussion. The course schedule / reading list---given in detail at the end of this syllabus---marks some papers with asterisks. In class, each of these papers will be presented by a student, who will both present the main ideas of the paper as well as their own thoughts and critiques. The paper will then be discussed amongst all of us as a group. We will assign presenters to papers early in the fall term. (Note: the Coase (1960) and Ostrom (1999) papers, which are starred on the reading list, will be group discussions without a presentation.)

My goal for each paper is to have a lively discussion. To this end, my plan and expectations for each paper are laid out below:

- **Main presentation:** The presenting student will present the paper for 20-25 minutes. The talk should motivate the paper's research question, explain the strategy for answering the question (including why that particular strategy was chosen), and then summarize the paper's results and their implications. Beyond presenting the paper as it was written, the presentation should also "discuss" the paper, as a discussant would at a conference. For instance, the presenter can help frame the importance of the paper within the literature and/or public policy, discuss the paper's strengths and weaknesses, discuss alternative approaches to the research question, and suggest future work (either to address the paper's weaknesses or to extend the paper's conclusions).

Since slides (via Powerpoint or Beamer) are the standard for economics talks these days, I expect them to be used here. During the presentation, audience members can ask clarifying questions, but we should save substantive comments and questions for the group discussion after the presentation. **Presenters should email their slides to me before class.**

- **Audience:** The audience is expected to contribute substantially to a group discussion of the paper following the presentation. Every student is expected to participate. To facilitate dialogue, every student who is not presenting the paper will, **no later than 5:00pm on the evening before class**, post comments about the paper into the discussion forum on the course's Canvas website. The comments should be the equivalent of 1-2 pages of text. Please organize your comments using the following headings:

1. Summary: What do you see as the main takeaways of the paper? What is the paper's contribution? What are the main tools the paper used to reach its conclusions (what is the paper's "lever")?
2. What did you most like about the paper?
3. What did you most dislike? What are some problems you see in the paper?
4. What questions do you have about the paper?

These comments can span issues such as the paper's strategy and results, concerns regarding the paper's strategy / methods, implications of the paper that you think are worth additional attention, parts of the paper that you find confusing, and any ideas for related follow-up research.

During our group discussions, please do not be afraid to bring up any aspects of the paper that you find confusing. Some of the papers we cover are quite complex, and I do not expect you to understand everything that the authors are doing. In some cases, the authors themselves may not fully understand what they are doing, nor may I. I know some of these papers quite well, but there are others with which I am only loosely familiar (since, e.g., they appeared just this past year). So I will be learning with you.

Grading

The course grades will break out as follows:

1. **CLASS PARTICIPATION / PRESENTATIONS (40% OF GRADE):** Your participation / presentation grade will be based on your presentations, audience discussions, and the comments you post before class laying out your thoughts on the day's papers. For each paper, I will NOT be grading you on the basis of whether your insights are correct or incorrect. I WILL be grading you on whether you are demonstrating a sincere effort to understand what each of the papers is trying to do, think critically about the papers' methods and conclusions, and contribute to the learning of the class as a whole. Again, I do not expect you to fully understand every aspect of every paper before coming to class—please arrive armed with any questions you have!
2. **PROBLEM SETS (20% OF GRADE):** Full credit if you make a sincere and well-reasoned effort at every problem. I won't go through your answers in detail to check for correctness, but I will post solutions to the problem set against which you should carefully check your work.
3. **COMPUTATIONAL ASSIGNMENT (10% OF GRADE):** Full credit if you make a sincere and well-reasoned effort at every problem. I won't go through your code in detail to check for correctness, but I will post my own code and output against which you should carefully check your work.
4. **EXAM (30% OF GRADE)**

Students taking the class pass/fail must achieve a letter grade of at least a B- to pass the course.

Textbook and general references / literature reviews

There is no required textbook, as our readings will primarily consist of research papers and, occasionally, book chapters. That said, a good graduate-level environmental economics textbook, with an emphasis on theory, is: Hanley, Shogren, and White, *Environmental Economics in Theory and Practice*, 2nd edition. New York: Palgrave Macmillan (2007).

I recommend Léonard, Daniel and Ngo van Long, *Optimal Control Theory and Static Optimization in Economics*, Cambridge University Press (1992) as a technical resource for the mathematics of optimal control problems.

For computational work, I recommend Judd, Kenneth L, *Numerical Methods in Economics*, MIT Press, 1998, which has thorough coverage of computational approaches for function approximation, non-linear equation solving, dynamic optimization, and so on. Another, more accessible resource is Miranda, Mario J. and Paul L. Fackler, *Applied Computational Economics and Finance*, MIT Press (2002).

There are two literature reviews that you can find in the “General” readings folder on Canvas:

- A review of the literature in natural resource and environmental economics through 1999 is: Pfaff, Alexander F. and Robert N. Stavins, “Readings in the Field of Natural Resource and Environmental Economics”, working paper (1999).
- A new review of the literature at the intersection of energy and environmental economics with industrial organization is: Kellogg, Ryan and Mar Reguant, “Energy and Environmental Markets, Industrial Organization, and Regulation”, in Handbook of Industrial Organization, volume 5, Ali Hortaçsu, Kate Ho, and Alessandro Lizzeri, Eds. Elsevier (2021), 615-742.

Auditing

I welcome students who satisfy the prerequisites and choose to audit the course. However, my class is a no-free-rider zone, so auditing students will be required to participate in class presentations and discussions as if they were taking the course for credit. Specifically, auditing students are required to post comments on papers presented by others and participate in class discussions. Auditors may also be asked to present a paper in class. **I will ask auditors to discontinue attendance if they are not contributing to the class discussions.** Auditors are exempt from turning in problem sets and from taking the exam.

Health

Nobody wants to be sick, including me. If you are feeling ill with Covid, the flu, or just an old-fashioned cold, let me know and do not come to class. I can record the class sessions in the event of last-minute absences for illnesses or other emergencies, though the recordings are admittedly imperfect.

PPHA 44320 Schedule and Readings, Fall 2022

THE LIST BELOW IS FROM FALL 2022 (WHICH MET FOR THREE HOURS ONCE PER WEEK). I WILL UPDATE THE TOPICS, DATES, AND READINGS BEFORE OUR FALL 2024 CLASS STARTS.

Required readings to be presented and discussed by students are in bold and marked with a (*). ALL students are required to read the required readings, not just the assigned presenter.

You are not required to read the other papers, but you should read them if you are interested in the topic and are considering related research.

THE SCHEDULE IS CURRENTLY TENTATIVE; I WILL POST A FINAL SCHEDULE ONCE ENROLLMENT IS FINALIZED AND PAPERS ARE ASSIGNED TO STUDENT PRESENTERS

WEEK 1:

TOPICS: COURSE INTRODUCTION; PRESENTATION SKILLS

Li, Shengwu, "How to Give an Economic Theory Talk", mimeo (2021).

Shapiro, Jesse M., "How to Give an Applied Micro Talk: Unauthoritative Notes", slide presentation.

WEEK 2:

TOPICS: CONSTRAINED OPTIMIZATION AND DISCRETE-TIME DYNAMIC PROGRAMMING; EXHAUSTIBLE NATURAL RESOURCE PRODUCTION; VALUE FUNCTIONS; GREEN PARADOX

(* **Blundell, Wesley, Gautam Gowrisankaran, and Ashley Langer, "Escalation of Scrutiny: The Gains from Dynamic Enforcement of Environmental Regulations", *American Economic Review* (2020), 2558-2585. (Also see model in appendix A1)**

(* **Lemoine, Derek, "Green Expectations: Current Effects of Anticipated Carbon Pricing", *Review of Economics and Statistics* 99 (2017), 499-513.**

Baumol, William, "Kuhn-Tucker Methods", in *Economic Theory and Operations Analysis* 4th ed., Prentice-Hall (1977) p. 156-176.

Gaudet, Gerard, "Natural Resource Economics Under the Rule of Hotelling", address delivered at the 41st annual meetings of the Canadian Economics Association (2007).

Gaudet, Gerard, and Stephen W. Salant, "The Hotelling Model with Multiple Demands", working paper (2013).

Gray, Jo Anna and Stephen W. Salant, "Transversality Conditions in Infinite Horizon Models", International Finance Discussion Paper 172 (1981).

- Herfindahl, Orris C., “Depletion and Economic Theory”, in *Extractive Resources and Taxation*, Ed. Mason Gaffney, University of Wisconsin Press (1967), pp. 68-90.
- Hotelling, Harold, “The Economics of Exhaustible Resources,” *Journal of Political Economy* 39 (1931), 137-175.
- Levhari, David and Robert S. Pindyck, “The Pricing of Durable Exhaustible Resources,” *Quarterly Journal of Economics* 96 (1981), 365-378.
- Moreno-Cruz, Juan, and M. Scott Taylor, “A Spatial Approach to Energy Economics”, working paper (2013).
- Olson, Lars, “Handout: A Review of Dynamic Optimization and Optimal Control Theory”

WEEK 3:

TOPICS: CONTINUOUS TIME DYNAMIC PROGRAMMING; CONSTRAINED EXHAUSTIBLE NATURAL RESOURCE PRODUCTION; RESOURCE EXPLORATION

- (*) Heal, Geoffrey and Wolfram Schlenker, “Coase, Hotelling, and Pigou: The Incidence of a Carbon Tax and CO2 Emissions”, NBER working paper #26086 (2019).**
- (*) Lewis, Eric, “Patchwork Policies, Spillovers, and the Search for Oil and Gas”, *American Economic Journal: Economic Policy* 11 (2019), 380-405.**
- Adelman, Morris, “Mineral Depletion, with Special Reference to Petroleum”, *Review of Economics and Statistics* 72 (1990), 1-10.
- Anderson, Soren T., Ryan Kellogg, and Stephen W. Salant, “Hotelling Under Pressure”, *Journal of Political Economy* 126 (2018), 984-1026.
- Bornstein, Gideon, Per Krusell, and Sergio Rebelo, “A World Equilibrium Model of the Oil Market”, *Review of Economic Studies* (forthcoming).
- Holland, Stephen P. “Modeling Peak Oil”, mimeo (2006). (Much shorter version eventually published in *Energy Journal* 29 (2008), 61-80.)
- Newell, Richard G. and Brian C. Prest, “The Unconventional Oil Supply Boom: Aggregate Price Response from Microdata”, *Energy Journal* 40 (2019).
- Newell, Richard G., Brian C. Prest, and Ashley Vissing, “Trophy Hunting vs. Manufacturing Energy: The Price-Responsiveness of Shale Gas”, *Journal of the Association of Environmental and Resource Economists* 6 (2019), 177-217.
- Pindyck, Robert S., “The Optimal Exploration and Production of Nonrenewable Resources”, *Journal of Political Economy* 86 (1978), 841-861.
- Slade, Margaret E. and Henry Thille, “Whither Hotelling: Tests of the Theory of Exhaustible Resources”, *Annual Review of Resource Economics* 1 (2009), 239-259.
- Stiglitz, Joseph E., “Monopoly and the Rate of Extraction of Exhaustible Resources,” *American Economic Review* 66 (1976), 655-661.

WEEK 4:

TOPICS: SOLVING DYNAMIC PROBLEMS ON THE COMPUTER; INVESTMENT UNDER UNCERTAINTY; ABOVE-GROUND STORAGE AND SPECULATION

(*) **Knittel, Christopher R. and Robert S. Pindyck, “The Simple Economics of Commodity Price Speculation”, *American Economic Journal: Macroeconomics* 8 (2016), 1-27.**

Arrow, Kenneth J. and Anthony C. Fisher, “Environmental Preservation, Uncertainty, and Irreversibility”, *Quarterly Journal of Economics* 88 (1974), 312-319.

Black, Fischer, and Myron Scholes. 1973. “The Pricing of Options and Corporate Liabilities.” *Journal of Political Economy* 81(3): 637-654.

Dixit, Avinash K., “Investment and Hysteresis”, *Journal of Economic Perspectives* 6 (1992), 107-132.

Dixit, Avinash K., and Robert S. Pindyck. 1994. *Investment Under Uncertainty*, Princeton, NJ: Princeton University Press.

Kellogg, Ryan, "The Effect of Uncertainty on Investment: Evidence from Texas Oil Drilling," *American Economic Review* 104 (June, 2014), 1698-1734.

McDonald, Robert and Daniel Siegel, “The Value of Waiting to Invest”, *Quarterly Journal of Economics* 101 (1986), 707-728.

Paddock, James L., Daniel R. Siegel, and James L. Smith, “Option Valuation of Claims on Real Assets: The Case of Offshore Petroleum Leases”, *Quarterly Journal of Economics* 103 (1988), 479-508.

Pindyck, Robert S. “Irreversibility, Uncertainty, and Investment.” *Journal of Economic Literature* 29 (1991), 1110-1148.

Pindyck, Robert S., “The Dynamics of Commodity Spot and Futures Markets: A Primer”, *Energy Journal* 22 (2001), 1-29.

Salant, Stephen W. and Dale W. Henderson, “Market Anticipations of Government Policies and the Price of Gold”, *Journal of Political Economy* 86 (1978), 627-648.

Salant, Stephen W., “The Vulnerability of Price Stabilization Schemes to Speculative Attack”, *Journal of Political Economy* 91 (1983), 1-38.

Samuelson, Paul A., “Intertemporal Price Equilibrium: A Prologue to the Theory of Speculation”, *Weltwirtschaftliches Archiv*. 79 (1957), 181-221.

WEEK 5:

TOPICS: RENEWABLE RESOURCES; COMMON POOLS; PIGOUVIAN TAXATION;
COASE AND ALTERNATIVES TO PIGOUVIAN TAXATION

(*) (no presentation, but to be read and discussed by all) Coase, Ronald H., “The Problem of Social Cost”, *Journal of Law and Economics* III (1960), pp. 1-44.

(*) (no presentation, but to be read and discussed by all) Ostrom, Elinor, “Coping With Tragedies of the Commons”, *Annual Review of Political Science* 2 (1999), 493-535.

Ayers, Andrew B., Kyle C. Meng, and Andrew J. Plantinga, “Do Property Rights Alleviate the Problem of the Commons? Evidence from California Groundwater Rights”, NBER working paper #26268 (2019).

Banzhaf, H. Spencer, “A History of Pricing Pollution (Or, Why Pigouvian Taxes Are Not Necessarily Pigouvian)”, NBER working paper #27683 (2020).

Baumol, William J., “On Taxation and the Control of Externalities”, *American Economic Review* 62 (1972), 307-322.

Coppock, D. Layne, Lucas Crowley, Susan L. Durham, Dylan Groves, Julian C. Jamison, Dean Karlan, Brien E. Norton, and R. Douglas Ramsey, “Cooperation in the Commons: Community-Based Rangeland Management in Namibia” NBER working paper #29469 (2021).

Dasgupta, P.S. and G.M. Heal, “Externalities”, in *Economic Theory and Exhaustible Resources*. Cambridge University Press (1979), 55-78.

Deacon, Robert T., Dominic P. Parker, and Christopher Costello, “The Efficiency Gains from Coordinating Use of a Shared Resource: Evidence from a Self-Selected Fishery Coop” *Journal of Law and Economics* 56 (2013), pp. 83-125.

Farrell, Joseph, “Information and the Coase Theorem”, *Economic Perspectives* 1 (1987), 113-129.

Gordon, H. Scott, “The Economic Theory of a Common-Property Resource: The Fishery”, *Journal of Political Economy* 62 (1954), 124-142.

Harstad, Bard, “Buy Coal! A Case for Supply-Side Environmental Policy”, *Journal of Political Economy* 120 (2012), 77-115.

Libecap, Gary D., “Addressing Global Environmental Externalities: Transactions Cost Considerations”, NBER working paper 19501 (2013).

Libecap, Gary D., “Coasean Bargaining to Address Environmental Externalities”, NBER working paper #21903 (2016).

Libecap, Gary D. and Steven N. Wiggins, “Contractual Responses to the Common Pool: Prorating of Crude Oil Production”, *American Economic Review* 74 (1984), 87-98.

Libecap, Gary D. and Steven N. Wiggins, “The Influence of Private Contractual Failure on Regulation: The Case of Oil Field Unitization”, *Journal of Political Economy* 93 (1985), 690-714.

Ostrom, Elinor, *Governing the Commons: The Evolution of Institutions for Collective Action (Political Economy of Institutions and Decisions)*, Cambridge University Press (1990).

Pigou, Arthur C., *The Economics of Welfare*. London: Macmillan (1920).

- Taylor, M. Scott, "Buffalo Hunt: International Trade and the Virtual Extinction of the North American Bison", *American Economic Review* 101 (Dec., 2011).
- Usher, Dan, "The Coase theorem is tautological, incoherent, or wrong", *Economics Letters* 11 (1998), 3-11.
- Wiggins, Steven N. and Gary D. Libecap, "Oil Field Unitization: Contractual Failure in the Presence of Imperfect Information", *American Economic Review* 75 (1985), 368-385.

WEEK 6:

TOPICS: COMMON POOLS; PRICE VS. QUANTITY STANDARDS; ECONOMICS OF TRADEABLE EMISSION PERMITS AND QUANTITY STANDARDS

(*) Ryan, Nicholas and Anant Sudarshan, "Rationing the Commons", NBER working paper #27473 (2020).

- Borenstein, Severin, James Bushnell, Frank A. Wolak, and Matthew Zaragoza-Watkins, "Expecting the Unexpected: Emissions Uncertainty and Environmental Market Design", *American Economic Review* 109 (2019), 3953-3977.
- Bushnell, James B., "The Economics of Carbon Offsets", in *The Design and Implementation of U.S. Climate Policy*, Don Fullerton and Catherine Wolfram, editors. University of Chicago Press (2012).
- Bushnell, James B., Howard Chong, and Erin T. Mansur, "Profiting from Regulation: Evidence from the European Carbon Market", *American Economic Journal: Economic Policy* 5 (2013), 78-106.
- Carlson, Curtis, Dallas Burtraw, Maureen Cropper, and Karen L. Palmer, "Sulfur Dioxide Control by Electric Utilities: What Are the Gains from Trade?" *Journal of Political Economy* 108 (2000), 1292-1326.
- Ellerman, A. Denny, "Ex Post Evaluation of Tradeable Permits: The U.S. SO₂ Cap-and-Trade Program", MIT working paper 03-003 (2003).
- Goulder, Larry H., "Markets for Pollution Allowances: What are the (New) Lessons?", *Journal of Economic Perspectives* 27 (2013), 87-102.
- Goulder, Lawrence H. and Andrew Schein, "Carbon Taxes vs. Cap and Trade: A Critical Review", *Climate Change Economics* 4 (2013).
- Harris, Robert I. and William A. Pizer, "Using Taxes to Meet an Emissions Target", NBER working paper #27781 (2020).
- Hasegawa, Makoto, and Stephen Salant, "Cap-and-trade Programs Under Delayed Compliance: Consequences of Interim Injections of Permits", *Journal of Public Economics* 119 (2014), 24-34.
- Kaplow, Louis, "Taxes, Permits, and Climate Change," NBER working paper #16268 (2010).
- Kaplow, Louis, and Steven Shavell, "On the Superiority of Corrective Taxes to Quantity Regulation," *American Law and Economics Review*, 4 (2002), 1-17.

- Kellogg, Ryan, “Gasoline Price Uncertainty and the Design of Fuel Economy Standards”, *Journal of Public Economics* 160 (2018), 14-32.
- Malcomson, James M., “Prices vs. Quantities: A Critical Note on the Use of Approximations,” *Review of Economic Studies* 45 (Feb., 1978), 203-207.
- Millock, Katrin, David Sunding, and David Zilberman, “Regulating Pollution with Endogenous Monitoring”, *Journal of Environmental Economics and Management* 44 (2002), 221-241.
- Montero, Juan-Pablo, “Voluntary Compliance with Market-Based Environmental Policy: Evidence from the U.S. Acid Rain Program”, *Journal of Political Economy* 107 (1999), 998-1033.
- Montero, Juan-Pablo, “Optimal Design of a Phase-in Emissions Trading Program”, *Journal of Public Economics* 75 (2000), 273-291.
- Montero, Juan-Pablo, “Pollution Markets with Imperfectly Observed Emissions”, *RAND Journal of Economics* 36 (2005), 645-660.
- Pizer, William A. and Brian Prest, “Prices Versus Quantities with Policy Updating,” *Journal of the Association of Environmental and Resource Economists*, forthcoming.
- Schmalensee, Richard and Robert N. Stavins, “The SO₂ Allowance Trading System: the Ironic History of a Grand Policy Experiment”, *Journal of Economic Perspectives* 27 (2013), 103-122.
- Schmalensee, Richard and Robert Stavins, “Lessons Learned from Three Decades of Experience with Cap-and-Trade”, NBER working paper 21742 (2016).
- Segerson, Kathleen, “Uncertainty and Incentives for Nonpoint Pollution Control”, *Journal of Environmental Economics and Management* 15 (1988), 87-98.
- Spulber, Daniel F., “Optimal Environmental Regulation Under Asymmetric Information”, *Journal of Public Economics* 35 (1988), 163-181.
- Weitzman, Martin L., “Prices vs. Quantities,” *Review of Economic Studies* 41 (Oct., 1974), 477-491.
- Weitzman, Martin L., “Reply to ‘Prices vs. Quantities: A Critical Note on the Use of Approximations’,” *Review of Economic Studies* 45 (Feb., 1978), 209-210.

WEEK 7:

TOPICS: PERMIT MARKETS; TARGETING; INTENSITY STANDARDS

- (* **Jacobsen, Mark R., Christopher R. Knittel, James M. Sallee, and Arthur A. van Benthem, “The Use of Regression Statistics to Analyze Imperfect Pricing Policies”, *Journal of Political Economy* 128 (2020), 1826-1876.**
- (* **Lemoine, Derek, “Incentivizing Negative Emissions Through Carbon Shares”, working paper (2021).**
- Holland, Stephen P., Jonathan E. Hughes, and Christopher R. Knittel, “Greenhouse Gas Reductions Under Low Carbon Fuel Standards?” *American Economic Journal: Economic Policy* 1 (2009), 106-146.

- Diamond, Peter A., "Consumption Externalities and Imperfect Corrective Pricing", *Bell Journal of Economics and Management Science* 4 (1973), 526-538.
- Kellogg, Ryan, "Output and Attribute-Based Carbon Regulation Under Uncertainty", *Journal of Public Economics* 190 (2020), 104246.

WEEK 8:

TOPICS: ATTRIBUTE-BASED STANDARDS; POLLUTION CONTROL IN SECOND BEST SETTINGS; MARKET POWER AND LEAKAGE

- (*) Ito, Koichiro and James M. Sallee, "The Economics of Attribute-Based Regulation: Theory and Evidence from Fuel-Economy Standards", *Review of Economics and Statistics* 100 (May, 2018), 319-336.
- (*) Weisbach, David, Samuel S. Kortum, Michael Wang, and Yujia Yao, "Trade, Leakage, and the Design of a Carbon Tax", NBER working paper #30244 (2022).
- Baylis, Kathy, Don Fullerton, and Daniel H. Karney, "Negative Leakage", *Journal of the Association of Environmental and Resource Economists* 1 (2014), 51-73.
- Buchanan, James M., "External Diseconomies, Corrective Taxes, and Market Structure," *American Economic Review* 59 (1969), 174-177.
- Cicala, Steve, David Hémons, and Morten G. Olsen, "Adverse Selection as a Policy Instrument: Unraveling Climate Change", NBER working paper #30283 (2022).
- Fischer, Carolyn and Stephen W. Salant, "Limits to Limiting Greenhouse Gases: Intertemporal Leakage, Spatial Leakage, and Negative Leakage", working paper (2013).
- Fowlie, Meredith, Mar Reguant, and Stephen P. Ryan, "Market-Based Emissions Regulation and Industry Dynamics," *Journal of Political Economy* 124 (2016), 249-302.
- Ganapati, Sharat, Joseph S. Shapiro, and Reed Walker, "The Incidence of Carbon Taxes in U.S. Manufacturing: Lessons from Energy Cost Pass-Through", *American Economic Journal: Applied Economics*, forthcoming.
- Hahn, Robert W., "Market Power and Transferable Property Rights," *Quarterly Journal of Economics* 99 (Nov., 1984), 753-765.
- Holland, Stephen P., "Taxes and Trading Versus Intensity Standards: Second-Best Environmental Policies With Incomplete Regulation (Leakage) or Market Power," *Journal of Environmental Economics and Management* 63 (2012), 375-387.
- Martin, Ralf, Mirabelle Muûls, Laure B. de Preux, and Ulrich J. Wagner, "Industry Compensation Under Relocation Risk: A Firm-Level Analysis of the EU Emissions Trading Scheme", *American Economic Review* 104 (2014), 2482-2508.
- Preonas, Louis, "Market Power in Coal Shipping and Implications for U.S. Climate Policy", working paper (2018).

WEEK 9:

TOPICS: POLLUTION CONTROL IN SECOND BEST SETTINGS: TAX AND REGULATORY DISTORTIONS; DISTRIBUTIONAL IMPACTS OF POLICIES

- (*) **Hernandez-Cortes, Danae and Kyle C. Meng, “Do Environmental Markets Cause Environmental Injustice? Evidence from California’s Carbon Market”, NBER working paper #27205 (April, 2021).**
- (*) **Sallee, James M., “Pigou Creates Losers: On the Implausibility of Achieving Pareto Improvements from Efficiency-Enhancing Policies”, working paper (2019).**
- Borenstein, Severin and James Bushnell, “Do Two Electricity Pricing Wrongs Make a Right? Cost Recovery, Externalities, and Efficiency” Energy Institute at Haas working paper #294 (2018).
- Borenstein, Severin and James B. Bushnell, “Headwinds and Tailwinds: Implications of Inefficient Retail Energy Pricing for Energy Substitution”, NBER working paper #29118 (2021).
- Borenstein, Severin and Ryan Kellogg, “Carbon Pricing, Clean Electricity Standards, and Clean Electricity Subsidies on the Path to Zero Emissions”, NBER working paper #30263 (2022).
- Cronin, Julie Anne, Don Fullerton, and Steven Sexton, “Vertical and Horizontal Redistributions from a Carbon Tax and Rebate”, *Journal of the Association of Environmental and Resource Economists* 6 (2019).
- Davis, Lucas W., and Erich Muehlegger, “Do Americans Consume Too Little Natural Gas? An Empirical Test of Marginal Cost Pricing,” *RAND Journal of Economics* 41 (2010), 791-810.
- Glaeser, Edward L., Caitlin S. Gorbach, and James M. Poterba, “How Regressive are Mobility-Related User Fees and Gas Taxes?” working paper (2022).
- Goulder, Lawrence H., Marc A.C. Hafstead, GyuRim Kim, and Xianling Long, “Impacts of a Carbon Tax Across US Household Income Groups: What are the Equity-Efficiency Trade-offs?” *Journal of Public Economics* 175 (2019), 44-64.
- Goulder, Lawrence H., Ian W.H. Parry, and Dallas Burtraw, “Revenue-Raising Versus Other Approaches to Environmental Protection: The Critical Significance of Pre-Existing Tax Distortions,” *RAND Journal of Economics* 28 (Winter, 1997), 708-731.
- Goulder, Lawrence H., Ian W.H. Parry, Robertson C. Williams III, and Dallas Burtraw, “The Cost-Effectiveness of Alternative Instruments for Environmental Protection in a Second-Best Setting,” *Journal of Public Economics* 72 (1999), 329-360.
- Goulder, Lawrence H. and Robertson C. Williams III, “The Substantial Bias from Ignoring General Equilibrium Effects in Estimating Excess Burden, and a Practical Solution”, *Journal of Political Economy* 4 (2003), 898-927.
- Reguant, Mar, “The Efficiency and Sectoral Distributional Impacts of Large-Scale Renewable Policies”, *Journal of the Association of Environmental and Resource Economics*, forthcoming.
- Sherman, Roger and Michael Visscher, “Rate-of-Return Regulation and Two-Part Tariffs”, *Quarterly Journal of Economics* 97 (1982), 27-42.

West, Sarah E. and Roberton C. Williams III, "Optimal Taxation and Cross-Price Effects on Labor Supply: Estimates of the Optimal Gas Tax," *Journal of Public Economics* 91 (2007), 593-617.

Williams, Roberton C. III, "Environmental Taxation", NBER working paper #22303 (2016).