

**ECON 260B**  
**GRADUATE ENVIRONMENTAL ECONOMICS**  
**SPRING 2019**

**Time and Location:** Tuesday/Thursday, 2:00-3:15pm 2212 North Hall

**Instructor:** Kyle Meng

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**Office Hours:** Thursday, 9:30-11:00am (2x45 minute slots), 4416 Bren Hall. Sign-up [here](#).

## Overview and Objectives

This graduate-level course covers key theoretical and empirical results in environmental economics. In particular, the course is designed with a lens towards how theoretical insights can inform and be subjected to rigorous empirical tests. Theoretical topics include optimal environmental policy; cost-effective environment policy and instrument choice; second-best environment policy; equilibrium sorting; directed technical change; trade and environmental policy. Empirical applications include hedonic, cost of illness, sorting, and sufficient statistic methods.

## Grading

The grade for this course will have four components:

1. **2 referee reports, one with additional analysis (2x25%):** Students will be asked to critically evaluate 2 papers. For each paper, students will be asked to write a referee report. In addition, for one referee report, students must perform, report, and discuss at least one additional empirical test of the paper's central identifying assumption involving additional data collection.
2. **In-class presentation of original research project (40%):** 30 minute research presentation on a topic in environmental and resource economics, with a lens towards an eventual job market paper. This talk can take two forms. If it is new work that has not been previously prepared for another class preliminary results will suffice. If the student chooses to work on advancing an existing paper, the student must submit an existing version of the paper (perhaps for another class) at the beginning of the quarter with the understanding that the presentation given at the end of the quarter exhibit substantial advances with a full set of results. Students uncertain about whether to pursue new or existing research may submit an existing paper at the start of the quarter to maintain the option value of deciding later.
3. **Class participation (10%):** Students are expected to attend all lectures with readings assigned to each lecture. During each lecture, 1 student will be randomly selected to give a 5 minute overview of the papers required for that class.

## Readings

Lectures will not be based on any single book. Some books that informed our lectures are:

- Baumol, W. J. and Oates, W. E. (1988). *The Theory of Environmental Policy, Second Edition*. Cambridge University Press
- Kolstad, C. D. (2011). *Environmental Economics, Second Edition*. Oxford University Press
- Phaneuf, D. J. and Requate, T. (2016). *A Course in Environmental Economics: Theory, Policy, and Practice*. Cambridge University Press

Baumol and Oates (1988) is the foundational textbook on the theory of environmental policy. It covers many key theoretical results in the field. While it is a bit dated, the book's insights remain important and have informed empirical work in recent years. Kolstad (2011) is a thorough, modern treatment of the field. There is also an added emphasis on empirical applications. However, the textbook is written at an advanced undergraduate level and should be studied in conjunction with Baumol and Oates (1988). Phaneuf and Requate (2016) covers nearly all topics in the field at a high level. Notation is consistent throughout and the treatment of non-market valuation is particularly thorough. Each lecture will be accompanied by a list of readings. Entries noted by an asterisk (\*) are required reading prior to each lecture.

## Course Outline

### I. Introduction (1 lecture)

#### Topics:

- Overview
- Review of market equilibrium and welfare economics.
- Review of externalities, public goods, and the Samuelson condition.

#### Readings:

- \*Cropper, M. L. and Oates, W. E. (1992). Environmental economics: A survey. *Journal of Economic Literature*, 30(2):pp. 675–740
- Baumol and Oates (1988) Ch. 3.
- Kolstad (2011) Ch. 3-5.

### I. Environmental Policy Design (5 lectures)

#### Lecture 2: First-best optimal environmental policy - instrument equivalence

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#### Readings:

- \* Baumol and Oates (1988) Ch. 4.
- Kolstad (2011) Ch. 4, 5.

- \*Fowlie, M. and Perloff, J. M. (2013). Distributing pollution rights in cap-and-trade programs: Are outcomes independent of allocation? *Review of Economics and Statistics*, 95(5):1640–1652

### Lecture 3: First-best optimal environmental policy - instrument divergence

#### **Readings:**

- \* Baumol and Oates (1988) Ch. 5.
- Carlton, D. W. and Loury, G. C. (1980). The limitations of pigouvian taxes as a long-run remedy for externalities\*. *The Quarterly Journal of Economics*, 95(3):pp. 559–566
- Weitzman, M. L. (1974). Prices vs. quantities. *The Review of Economic Studies*, 41(4):pp. 477–491
- Roberts, M. J. and Spence, M. (1976). Effluent charges and licenses under uncertainty. *Journal of Public Economics*, 5(34):193 – 208
- Laffont, J. J. (1977). More on prices vs. quantities. *The Review of Economic Studies*, 44(1):pp. 177–182
- Kolstad (2011) Ch. 15.

### Lecture 4: Second-best optimal environmental policy: market power and tax-interaction

#### **Readings:**

- \*Baumol and Oates (1988) Ch. 6.
- Buchanan, J. M. (1969). External diseconomies, corrective taxes, and market structure. *The American Economic Review*, 59(1):pp. 174–177
- \*Barnett, A. H. (1980). The pigouvian tax rule under monopoly. *The American Economic Review*, 70(5):pp. 1037–1041
- \*Goulder, L. H. (1998). Environmental Policy Making in a Second-Best Setting. *Journal of Applied Economics*, 0:279–328
- Fowlie, M., Reguant, M., and Ryan, S. P. (2014). Market-based emissions regulation and industry dynamics. *Journal of Political Economy* (forthcoming)
- Kolstad (2011) Ch. 12.

### Lecture 5: Second-best optimal environmental policy: trade

#### **Readings:**

- \*Copeland, B. R. and Taylor, M. S. (2004). Trade, growth, and the environment. *Journal of Economic Literature*, 42(1):7–71
- \*Levinson, A. (2009). Technology, international trade, and pollution from us manufacturing. *American Economic Review*, 99(5):2177–92
- \*Aichele, R. and Felbermayr, G. (2014). Kyoto and carbon leakage: An empirical analysis of the carbon content of bilateral trade. *Review of Economics and Statistics*, 97(1):104–115

- Hanna, R. (2010). Us environmental regulation and fdi: Evidence from a panel of us-based multinational firms. *American Economic Journal: Applied Economics*, 2(3):158–89

## Lecture 6: Cost-effective environmental policy

### **Readings:**

- \*Baumol and Oates (1988) Ch. 11,12.
- \*Carlson, C., Burtraw, D., Cropper, M., and Palmer, K. L. (2000). Sulfur dioxide control by electric utilities: What are the gains from trade? *Journal of Political Economy*, 108(6):pp. 1292–1326
- \*Goulder, L. H. and Parry, I. W. H. (2008). Instrument choice in environmental policy. *Review of Environmental Economics and Policy*, 2(2):152–174
- \*Goulder, L. H. (2013). Markets for pollution allowances: What are the (new) lessons? *The Journal of Economic Perspectives*, 27(1):pp. 87–102
- \*Schmalensee, R. and Stavins, R. N. (2013). The so2 allowance trading system: The ironic history of a grand policy experiment. *Journal of Economic Perspectives*, 27(1):103–22
- Montgomery, W. D. (1972). Markets in licenses and efficient pollution control programs. *Journal of Economic Theory*, 5(3):395 – 418
- Rubin, J. D. (1996). A model of intertemporal emission trading, banking, and borrowing. *Journal of Environmental Economics and Management*, 31(3):269 – 286
- Gollop, F. M. and Roberts, M. J. (1985). Cost-minimizing regulation of sulfur emissions: Regional gains in electric power. *The Review of Economics and Statistics*, 67(1):pp. 81–90
- Ellerman, D. A. (2003). Ex post evaluation of tradable permits: The u.s. so2 cap-and-trade program. Technical report, Massachusetts Institute of Technology
- Kolstad (2011) Ch. 11-13.

## Lecture 7: From theory to causal inference

### **Readings:**

- \*Deschenes, O. and Meng, K. C. (2018). Quasi-experimental methods in environmental economics: Opportunities and challenges. In Dasgupta, P., Pattanayak, S. K., and Smith, V. K., editors, *Handbook of Environmental Economics*, volume 4 of *Handbook of Environmental Economics*, pages 285 – 332. Elsevier
- \*Timmins, C. and Schlenker, W. (2009). Reduced-form versus structural modeling in environmental and resource economics. *Annual Review of Resource Economics*, 1(1):351–380
- \*Chetty, R. (2009). Sufficient statistics for welfare analysis: A bridge between structural and reduced-form methods. *Annual Review of Economics*, 1(1):451–488
- \*Heckman, J. J. (2010). Building bridges between structural and program evaluation approaches to evaluating policy. *Journal of Economic literature*, 48(2):356–98

- Angrist, J. D. and Pischke, J.-S. (2010). The credibility revolution in empirical economics: How better research design is taking the con out of econometrics. *Journal of Economic Perspectives*, 24(2):3–30
- Keane, M. P. (2010). A structural perspective on the experimentalist school. *Journal of Economic Perspectives*, 24(2):47–58
- Nevo, A. and Whinston, M. D. (2010). Taking the dogma out of econometrics: Structural modeling and credible inference. *Journal of Economic Perspectives*, 24(2):69–82

## II. Cost of environmental policy 5 lectures

### Lecture 8: Estimating costs: partial equilibrium

#### Readings:

- \*Greenstone, M. (2002). The impacts of environmental regulations on industrial activity: Evidence from the 1970 and 1977 clean air act amendments and the census of manufactures. *Journal of Political Economy*, 110(6):pp. 1175–1219
- \*Walker, W. R. (2013). The transitional costs of sectoral reallocation: Evidence from the clean air act and the workforce\*. *The Quarterly Journal of Economics*, 128(4):1787–1835
- \*Greenstone, M., List, J. A., and Syverson, C. (2012). The effects of environmental regulation on the competitiveness of u.s. manufacturing. Working Paper 18392, National Bureau of Economic Research
- Becker, R. and Henderson, V. (2000). Effects of air quality regulations on polluting industries. *Journal of Political Economy*, 108(2):pp. 379–421
- Henderson, J. V. (1996). Effects of air quality regulation. *The American Economic Review*, 86(4):pp. 789–813
- Porter, M. E. and Linde, C. v. d. (1995). Toward a new conception of the environment-competitiveness relationship. *The Journal of Economic Perspectives*, 9(4):pp. 97–118

### Lecture 9: Estimating costs: general equilibrium

#### Readings:

- \*Pizer, W. A. and Kopp, R. (2005). Calculating the costs of environmental regulation. *Handbook of Environmental Economics*, 3:1307–1351
- \*Anderson, S. T. and Saltee, J. M. (2011). Using loopholes to reveal the marginal cost of regulation: The case of fuel-economy standards. *American Economic Review*, 101(4):1375–1409
- \*Meng, K. C. (2017). Using a free permit rule to forecast the marginal abatement cost of proposed climate policy. *American Economic Review*, 107(3):748–84
- \*Jacobsen, M. R., Knittel, C. R., Saltee, J. M., and van Benthem, A. A. (2016). Sufficient statistics for imperfect externality-correcting policies. Working Paper 22063, National Bureau of Economic Research

Lecture 10: Energy efficiency gap**Readings:**

- \*Gillingham, K. and Palmer, K. (2014). Bridging the energy efficiency gap: Policy insights from economic theory and empirical evidence. *Review of Environmental Economics and Policy*, 8(1):18–38
- \*Allcott, H. and Greenstone, M. (2012). Is there an energy efficiency gap? *Journal of Economic Perspectives*, 26(1):3–28
- \*Fowle, M., Greenstone, M., and Wolfram, C. (2015). Do energy efficiency investments deliver? evidence from the weatherization assistance program. Working Paper 21331, National Bureau of Economic Research

Lecture 11: Technical change and structural transitions**Readings:**

- \*Newell, R. G., Jaffe, A. B., and Stavins, R. N. (1999). The induced innovation hypothesis and energy-saving technological change. *The Quarterly Journal of Economics*, 114(3):941–975
- \*Popp, D. (2002). Induced innovation and energy prices. *American Economic Review*, 92(1):160–180
- \*Acemoglu, D., Aghion, P., Bursztyn, L., and Hemous, D. (2012). The environment and directed technical change. *American Economic Review*, 102(1):131–66
- \*Meng, K. C. (2019). Estimating path dependence in energy transitions. Working Paper 22536, National Bureau of Economic Research
- Griliches, Z. (1990). Patent statistics as economic indicators: A survey. *Journal of Economic Literature*, 28(4):pp. 1661–1707
- Jaffe, A., Newell, R., and Stavins, R. (2002). Environmental policy and technological change. *Environmental and Resource Economics*, 22(1-2):41–70
- Dechezleprtre, A. and Calel, R. (2014). Environmental policy and directed technological change: Evidence from the european carbon market. *Review of Economics and Statistics*

Lecture 12: Referee report with additional test**Readings:**

- Berk, J. B., Harvey, C. R., and Hirshleifer, D. (2017). How to write an effective referee report and improve the scientific review process. *Journal of Economic Perspectives*, 31(1):231–44
- Hornbeck, R. and Keskin, P. (2014). The historically evolving impact of the ogallala aquifer: Agricultural adaptation to groundwater and drought. *American Economic Journal: Applied Economics*, 6(1):190–219
- Data/code available from journal website.

### III. Benefits of environmental policy 6 lectures

#### Lecture 13: Hedonic Methods

##### Readings

- \*Rosen, S. (1974). Hedonic prices and implicit markets: Product differentiation in pure competition. *Journal of Political Economy*, 82(1):pp. 34–55
- \*Zhang, C., Boyle, K. J., and Kuminoff, N. V. (2013). Partial identification of amenity demand functions. *forthcoming at Journal of Environmental Economics and Management*
- \*Chay, K. Y. and Greenstone, M. (2005). Does air quality matter? evidence from the housing market. *Journal of Political Economy*, 113(2):pp. 376–424
- Currie, J., Davis, L., Greenstone, M., and Walker, R. (2013). Do housing prices reflect environmental health risks? evidence from more than 1600 toxic plant openings and closings. Technical report, National Bureau of Economic Research

#### Lecture 14: Referee report #2

- \*Ito, K. and Zhang, S. (2016). Willingness to pay for clean air: Evidence from air purifier markets in china. Working Paper 22367, National Bureau of Economic Research

#### Lecture 15: Sorting Models and Discrete Choice

- \*Roback, J. (1982). Wages, rents, and the quality of life. *Journal of Political Economy*, 90(6):pp. 1257–1278
- \*Kuminoff, N. V., Smith, V. K., and Timmins, C. (2013). The new economics of equilibrium sorting and policy evaluation using housing markets. *Journal of Economic Literature*, 51(4):1007–1062
- Epple, D. and Sieg, H. (1999). Estimating equilibrium models of local jurisdictions. *Journal of Political Economy*, 107(4):pp. 645–681
- Oates, W. E. and Schwab, R. M. (1988). Economic competition among jurisdictions: efficiency enhancing or distortion inducing? *Journal of public economics*, 35(3):333–354

#### Lecture 16: Cost of Illness and Avoidance Behavior

##### Readings

- \*Harrington, W. and Portney, P. R. (1987). Valuing the benefits of health and safety regulation. *Journal of urban Economics*, 22(1):101–112
- \*Moretti, E. and Neidell, M. (2011). Pollution, health, and avoidance behavior evidence from the ports of los angeles. *Journal of human Resources*, 46(1):154–175
- \*Schlenker, W. and Walker, W. R. (2016). Airports, air pollution, and contemporaneous health. *The Review of Economic Studies*, 83(2):768–809
- \*Deryugina, T., Heutel, G., Miller, N. H., Molitor, D., and Reif, J. (2016). The mortality and medical costs of air pollution: Evidence from changes in wind direction. Working Paper 22796, National Bureau of Economic Research

- Bartik, T. J. (1988). Evaluating the benefits of non-marginal reductions in pollution using information on defensive expenditures. *Journal of Environmental Economics and Management*, 15(1):111–127
- Chay, K. Y. and Greenstone, M. (2003). The impact of air pollution on infant mortality: Evidence from geographic variation in pollution shocks induced by a recession. *The Quarterly Journal of Economics*, 118(3):pp. 1121–1167
- Currie, J. and Neidell, M. (2005). Air pollution and infant health: What can we learn from california’s recent experience? *The Quarterly Journal of Economics*, 120(3):pp. 1003–1030
- Neidell, M. (2009). Information, avoidance behavior, and health: The effect of ozone on asthma hospitalizations. *The Journal of Human Resources*, 44(2):pp. 450–478

## Lecture 17: Estimating Climate Impacts

### Readings

- \*Mendelsohn, R., Nordhaus, W. D., and Shaw, D. (1994). The impact of global warming on agriculture: A ricardian analysis. *The American Economic Review*, 84(4):pp. 753–771
- \*Deschenes, O. and Greenstone, M. (2007b). The economic impacts of climate change: Evidence from agricultural output and random fluctuations in weather. *The American Economic Review*, 97(1):pp. 354–385
- \*Dell, M., Jones, B. F., and Olken, B. A. (2014). What do we learn from the weather? the new climate-economy literature. *Journal of Economic Literature*, 52(3):740–98
- \*Hsiang, S. (2016). Climate econometrics. *Annual Review of Resource Economics*, 8(1):43–75
- \*Lemoine, D. (2018). Estimating the consequences of climate change from variation in weather. Working Paper 25008, National Bureau of Economic Research
- Deschenes, O. and Greenstone, M. (2007a). Climate change, mortality, and adaptation: evidence from annual fluctuations in weather in the us
- Fisher, A. C., Hanemann, W. M., Roberts, M. J., and Schlenker, W. (2012). The economic impacts of climate change: Evidence from agricultural output and random fluctuations in weather: Comment. *The American Economic Review*, 102(7):pp. 3749–3760
- Dingel, J. I., Meng, K. C., and Hsiang, S. M. (2019). Spatial correlation, trade, and inequality: Evidence from the global climate. Working Paper 25447, National Bureau of Economic Research

## Lecture 18: Environment and Development

### Readings:

- \*Greenstone, M. and Jack, B. K. (2015). Envirodevonomics: A research agenda for an emerging field. *Journal of Economic Literature*, 53(1):5–42
- \*Burgess, R., Hansen, M., Olken, B. A., Potapov, P., and Sieber, S. (2012). The political economy of deforestation in the tropics. *The Quarterly Journal of Economics*, 1(48):48



- \*Alix-Garcia, J., McIntosh, C., Sims, K. R., and Welch, J. R. (2013). The ecological footprint of poverty alleviation: evidence from mexico's oportunidades program. *Review of Economics and Statistics*, 95(2):417–435
- \*Duflo, E., Greenstone, M., Pande, R., and Ryan, N. (2014). The value of regulatory discretion: Estimates from environmental inspections in india. Working Paper 20590, National Bureau of Economic Research
- Sekhri, S. (2011). Public provision and protection of natural resources: Groundwater irrigation in rural india. *American Economic Journal: Applied Economics*, 3(4):29–55
- Kremer, M., Leino, J., Miguel, E., and Zwane, A. P. (2011). Spring Cleaning: Rural Water Impacts, Valuation, and Property Rights Institutions\*. *The Quarterly Journal of Economics*, 126(1):145–205
- Oliva, P. (2015). Environmental regulations and corruption: Automobile emissions in mexico city. *Journal of Political Economy*, 123(3):pp. 686–724

Lecture 19-20: Student presentations