

# *Environmental & Resource Economics*

ECG 715

North Carolina State University

Fall 2020

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Class Hours: MW, 11:45am-1:00pm

Zoom Address: <https://ncsu.zoom.us/j/91808335731?pwd=VFFvSDBsMDZyREg0Nm9veGl2aDNXdz09>  
Meeting ID: 918 0833 5731  
PASSWORD: 715001

Website: Moodle (you will need your Unity ID and password to access this site)

Objectives: This course is the first in the environmental Ph.D. sequence. We will survey non-market valuation and environmental policy design.

Prerequisites: ECG 700 (or graduate-level microeconomic theory)

Text: NOTE: There is no required textbook, although you may want to purchase a few of the books listed below depending on your interests.

(Optional) Freeman, A. Myrick, Joseph Herriges and Catherine Kling. *The Measurement of Environmental & Resource Values: Theory and Methods, Third Edition*. Resources for the Future Press, Baltimore, 2014.

(Optional) Champ, Patricia, K.J. Boyle and Thomas Brown. *A Primer on Nonmarket Valuation, Second Edition*. Kluwer Academic Publishers, Dordrecht, 2017.

(Optional) Just, Richard, Darrell Hueth and Andrew Schmitz. *The Welfare Economics of Public Policy: A Practical Approach to Project and Policy Evaluation*. Edward Elgar, Northampton, 2005.

(Optional) Boardman, Anthony, David Greenberg, Aidan Vining and David Weimer. *Cost-Benefit Analysis: Concepts and Practice, 4<sup>th</sup> Edition*. Prentice Hall, Upper Saddle River, 2010.

(Optional) Haab, Timothy and Kenneth McConnell. *Valuing Environmental and Natural Resources: The Econometrics of Non-Market Valuation*. Edward Elgar, Northampton, 2003.

(Optional) Bockstael, Nancy and Kenneth McConnell. *Environmental and Resource Valuation with Revealed Preferences: A Theoretical Guide to Empirical Models*. Springer, Dordrecht, 2007.

(Optional) Stavins, Robert. *Economics of the Environment: Selected Readings, 6<sup>th</sup> Edition*. W.W. Norton, New York, 2012.

(Optional) Phaneuf, Daniel and Till Requate. *A Course in Environmental Economics: Theory, Policy and Practice*. Cambridge University Press, New York, 2016.

We have placed all of these books as well as the first two volumes of the *Handbook of Environmental Economics* on reserve under the course number in the D.H. Hill Library. In some cases we will put sections of these books on Moodle.

**Email:** Occasionally we will send emails with class announcements and materials. If you prefer a different email address than your NCSU Unity account, let us know.

**Grades:** Your final grade will be determined as follows:

Midterm ( <b>October 29<sup>th</sup></b> – <i>tentative</i> )	25%
Homeworks	20%
Research Proposal	30%
Seminar Reviews	15%
Moodle Forum Discussions / Class Presentations	15%

**HOMEWORKS:** We will have four graded homeworks throughout the semester. These will be a mix of mathematical problems and short answer/essays.

**TAKE-HOME MIDTERM:** 3-5 short answer and mathematical questions. You will have 24 hours.

**RESEARCH PROPOSAL:** The proposal should be around 15 pages in length on a topic of your choosing. The topic does not necessarily have to relate to a topic covered in class, although it must fall within the field of environmental and resource economics – please check with us. You *may not* use a paper you are writing for another class to satisfy this assignment.

A research proposal can be many things, but it should at a minimum include a few core sections. These include a description and motivation of the research question, a literature review, and a discussion of modeling, econometric, or data issues. Early in

the semester, we will give you some advice on working on a research proposal and our expectations. If you are planning to write a dissertation in environmental and resource economics, this is an excellent opportunity to start exploring topics. Due dates are as follows:

- A research topic and bibliography of roughly 15 academic papers. **Due September 30<sup>th</sup>**.
- A two-page description of and motivation for the research question you will explore. **Due October 7<sup>th</sup>**.
- A draft literature review section. **Due October 29<sup>th</sup>**.
- Final proposal. **Due November 16<sup>th</sup>**.

To increase the amount of constructive feedback that students receive, we plan on posting student deliverables to Moodle so that other students can provide helpful comments.

**SEMINAR REVIEWS:** We expect all enrolled students to be active participants in the Triangle Resource and Environmental Economics (TREE) seminar series. The series will have several presenters this semester and meet virtually on Thursdays. The current schedule is found here:

<https://cenrep.ncsu.edu/workshops/tree/>.

In addition to attending these seminars, we expect you to read the papers and write reports that contain constructive comments to be shared with the presenters. These comments should not be more than two pages, double-spaced, 12-point font, 1-inch margins. Recognizing that your busy lives may occasionally conflict with the seminar series, we will give you **one** excused absence (yes, we will be taking attendance) during the semester, and you will not have to submit a review for the seminar that you miss. However, we expect you to read all seminar papers and be ready to discuss them in class. If you cannot attend all but one of the TREE seminars, we may allow you to substitute a CEnREP colloquia:

<https://cenrep.ncsu.edu/workshops/cenrep-colloquia/>

or other virtual seminar series (e.g., [SWELL](#), [GoSee](#), [Climate Economics](#), [EPIC](#)).

**MOODLE DISCUSSION FORUMS / CLASS PRESENTATIONS:** Students will give short presentations (i.e., 15 minutes) on a relevant topic or paper(s) not covered in class. We will assign students to topics. We expect each presentation to include slides that concisely summarize the material. You should consult with us prior to your talk to make sure you are on the right track. Presentations will be spread throughout the semester.

We will also create Moodle forums on various topics that arise during the semester. Students will be expected to be active participants in all forums.

Academic Integrity:	<p>Academic misconduct includes, but is not limited to: cheating, aiding and abetting others to cheat, destruction or removal of academic material without permission, and plagiarism (<a href="#">NCSU POL11.35.01</a>).</p> <p>Uploading of student notes or other course documents to external websites or apps that encourage students to share course information is a violation of NC State's copyright regulation. Notes of classroom and laboratory lectures and exercises taken by students shall not be deemed Student Works, may only be used for personal educational purposes, and cannot be used for commercialization by the student generating such notes or by any third party (<a href="#">NCSU REG 01.25.03</a>).</p> <p>Students who commit academic misconduct or violate the copyright regulation will be referred to the Office of Student Conduct. Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (<a href="#">NCSU REG 11.35.02</a>).</p>
Community Standards:	<p>We are all responsible for protecting ourselves and our community. Please see the community expectations (<a href="#">NCSU Community Standards</a>) and Rule 04.21.01 regarding Personal Safety Requirements Related to COVID-19 (<a href="https://policies.ncsu.edu/rule/rul-04-21-01">https://policies.ncsu.edu/rule/rul-04-21-01</a>).</p>
Incomplete Grades & Withdrawals:	<p>University policy will be strictly followed, and incomplete grades will only be granted under exceptional circumstances.</p>

## Course Outline

The following is a tentative outline and reading list for the course. We will split our time between non-market valuation and the theory of environmental policy. The order and inclusion of topics on the reading list may change as we progress through the semester. We will announce required readings in advance of their coverage in class.

I have labeled each article with one of four codes that identify how it can be accessed:

- **BOOK** indicates the book containing the article is available under my name or the course number at the D.H. Hill Library's reserve room.
- **MOOD** indicates the article is available on Moodle.
- **EDB** indicates the article is available via an electronic database at the library, either JSTOR or a publisher provided format. The best way to access these articles is to search Econlit at <http://www.lib.ncsu.edu/searchcollection/databases/databases.php?alpha=E>.
- **\*\*\*** indicates readings of highest priority.

Let me know if you have difficulties accessing the materials.

## I. Public Goods & Externalities / Theory of Environmental Policy

Cornes, Richard and Todd Sandler. *The Theory of Externalities, Public Goods, and Club Goods*. Cambridge University Press, Cambridge, 1996, Chapters 3-4. (MOOD)

Baumol and Oates, Chapter 4. (MOOD) \*\*\*

Coase, Ronald. "The problem of social cost," *Journal of Law and Economics*, (1960):1-44. (MOOD)\*\*\*

## II. Background on Microeconometrics

Angrist, Joshua and Jörn-Steffen Pischke, "The credibility revolution in empirical economics: How better research design is taking the con out of econometrics," *Journal of Economic Perspectives*, (2010): 3-30. (EDB)\*\*\*

Imbens, Guido and Jeffrey Wooldridge. "Recent developments in the econometrics of program evaluation," *Journal of Economic Literature*, 47(2009): 5-86. (EDB)

Chetty, Raj. "Sufficient statistics for welfare analysis: A bridge between structural and reduced-form methods," *Annual Review of Economics*, 1(2009): 451-488. (MOOD)

List, John and Steven Levitt. "What do laboratory experiments measuring social preferences reveal about the real world?" *Journal of Economic Perspectives*, 21(2007): 153-174. (EDB)

## III. Theory of Economic Valuation

### A. Background

Segerson, Kathleen. "Valuing Environmental Good and Services: An Economic Perspective," Chapter 1 in P.A. Champ et al. *A Primer on Nonmarket Valuation*, Kluwer Academic Publishers, Dordrecht, 2017. (MOOD)\*\*\*

Krutilla, John. "Conservation reconsidered," *American Economic Review*, 57(1967): 777-786. (EDB)\*\*\*

Hanemann, W. Michael. "The economic conception of water," in P. Rogers, M. Llamas, and L. Martinez-Cortina, Editors, *Water Crisis: Myth or Reality?* Taylor and Francis, London, 2006. (MOOD) – especially section 2 –

Kelman, Steven. "Cost-benefit analysis: An ethical critique (with replies)," in Stavins, *Economics of the Environment: Selected Readings, 6<sup>th</sup> Edition*. W.W. Norton, New York, 2012. (MOOD)

Freeman, A. Myrick. "Economic valuation: What and why," Chapter 1 in P.A. Champ et al. *A Primer on Nonmarket Valuation*, Kluwer Academic Publishers, Dordrecht, 2003. (BOOK)

Executive Orders 12291 & 12866. (MOOD)

## B. Price Changes

Freeman et al., Chapter 3. \*\*\*

Just, Richard, Darrell Hueth and Andrew Schmitz. *The Welfare Economics of Public Policy: A Practical Approach to Project and Policy Evaluation*. Edward Elgar, 2005, Chapters 5-6. (BOOK)

Willig, Robert. "Consumer's surplus without apology," *American Economic Review*, 66(1976): 589-597. (EDB)

Hausman, Jerry. "Exact consumer's surplus and deadweight loss," *American Economic Review*, (1981): 662-676. (EDB)\*\*\*

Vartia, Yrjo. "Efficient methods of measuring welfare change and compensated income in terms of ordinary demand functions," *Econometrica*, 51(1983): 79-98. (EDB)

## C. Quantity/Quality Changes

Freeman et al., Chapter 3. \*\*\*

Bockstael, Nancy and Kenneth McConnell. "The behavioral basis of non-market valuation," Chapter 2 in J.A. Herriges and C.L. Kling, Editors, *Valuing Recreation and the Environment*, Edward Elgar, Northampton, 1999. (BOOK)

Dickie, Mark. "Averting Behavior Methods," Chapter 8 in P.A. Champ et al. *A Primer on Nonmarket Valuation*, Kluwer Academic Publishers, Dordrecht, 2017. (MOOD)

Larson, Douglas. "Recovering weakly complementary preferences," *Journal of Environmental Economics and Management*, 21(1992): 97-108. (MOOD)\*\*\*

Bockstael, Nancy and Kenneth McConnell, "Public goods as characteristics of non-market commodities," *Economic Journal*, 103(1993): 1244-1257. (EDB)

Bullock, David and Nicholas Minot. "On measuring the value of a nonmarket good using market data," *American Journal of Agricultural Economics*, 88(2006): 961-973. (EDB)

von Haefen, Roger. "Empirical strategies for incorporating weak complementarity into continuous demand models," *Journal of Environmental Economics and Management*, 54(2007): 15-31. (EDB)\*\*\*

## D. WTP versus WTA

Hanemann, W. Michael. "Willingness to pay versus willingness to accept: How much can they differ?" *American Economic Review*, 81(1991): 635-647. (EDB)\*\*\*

Shogren, Jason et al. "Resolving differences in willingness to pay and willingness to accept," *American Economic Review*, 84(1994): 255-270. (EDB)\*\*\*

Horowitz, John and Kenneth McConnell. "A review of WTA/WTP studies," *Journal of Environmental Economics and Management*, 44(2002): 426-447. (EDB)

Plott, Charles and Kathryn Zeiler. "The willingness to pay/willingness to accept gap, the endowment effect, subject misconceptions and experimental procedures for eliciting valuations," *American Economic Review*, 95(2005): 530-45. (EDB)

## E. Measuring Welfare Under Uncertainty

Freeman et al., Chapter 5. \*\*\*

Mäler, Karl-Göran and Anthony Fisher. "Environment, uncertainty, and option values," Chapter 13 in K.G. Mäler and J.R. Vincent, *Handbook of Environmental Economics, Volume 2*, Elsevier, Amsterdam, 2005. (BOOK)

Graham, Daniel. "Cost-benefit analysis under uncertainty," *American Economic Review*, 71(1981): 715-725. (EDB)

Cook, Phillip and Daniel Graham. "The demand for insurance and protection: The case of irreplaceable goods," *Quarterly Journal of Economics*, 91(1977): 143-156. (EDB)

Hanemann, W. Michael. "Information and the concept of option value," *Journal of Environmental Economics and Management*, 16(1989): 23-37. (MOOD)

Kahneman, Daniel and Amos Tversky. "Prospect theory: An analysis of decision under risk," *Econometrica*, 47(1979): 263-291. (EDB)\*\*\*

List, John. "Neoclassical theory versus prospect theory: Evidence from the marketplace," *Econometrica*, 72(2004): 615-625. (EDB)\*\*\*

## F. Recreation Demand

Freeman et al., Chapter 9.

English, Eric, et al. "The value of lost user days from the Deepwater Horizon oil spill," *Journal of Environmental Economics and Management*, in press. (EDB) \*\*\*

Glasgow, Garrett, and Kenneth Train. "Lost use-value from environmental injury when visitation drops at undamaged sites," *Land Economics*, 94:1(2018): 87-96. (EDB) \*\*\*

English, Eric, Roger Tourangeau, and Eric Horsch. "Lost use-value from environmental injury when visitation drops at undamaged sites: Comment," *Land Economics*, 95:1(2019): 146-151. (EDB) \*\*\*

Glasgow, Garrett, and Kenneth Train. "Lost use-value from environmental injury when visitation drops at undamaged sites: Reply," *Land Economics*, 95:1(2019): 152-156. (EDB) \*\*\*

Holzer, Jorge and Kenneth McConnell. "Discrete choice models under belief errors: The case of risk aversion," unpublished manuscript, 2018. (MOOD)

Fezzi, Carlo, Ian Bateman and Silvia Ferrini. “Using revealed preferences to estimate the value of travel time to recreation sites,” *Journal of Environmental Economics and Management*, 67(2014): 58-70. (EDB) \*\*\*

English, Eric, Kenneth McConnell, Roger H. von Haefen and Frank Lupi. “Should single and multi-day trips be combined when estimating travel cost models?” unpublished manuscript, 2019. (MOOD)\*\*\*

Timmins, Christopher and Jenifer Murdock. “A revealed preference approach to the measurement of congestion in travel cost models,” *Journal of Environmental Economics and Management*, 53:2(2007): 230-249. (EDB) \*\*\*

Hanemann, W. Michael. “Welfare analysis with discrete choice models”, Chapter 2 in J.A. Herges and C.L. Kling, Editors, *Valuing Recreation and the Environment*, Edward Elgar, Northampton, 1999. (MOOD)

Leggett, Christopher. “Environmental valuation with imperfect information: The case of the random utility model,” *Environmental and Resource Economics*, 23(3): 343-355. (EDB)

Lupi, Frank et al. “Best Practices for Recreation Demand Modeling,” *Review of Environmental Economics and Policy*, forthcoming. (MOOD)\*\*\*

Dundas, Steven and Roger H. von Haefen. “The effects of weather on recreational fishing demand and adaptation: Implications for a changing climate,” *Journal of the Association of Environmental and Resource Economists*, 7:2(2020): 209-242. (EDB)

## G. Property Value Models

Freeman et al., Chapters 10.

Taylor, Laura. “Hedonics,” Chapter 7 in P.A. Champ et al. *A Primer on Nonmarket Valuation*, Kluwer Academic Publishers, Dordrecht, 2017. (MOOD)

Rosen, Sherwin. “Hedonic prices and implicit markets: Product differentiation in pure competition,” *Journal of Political Economy*, 82(1974): 34-55. (EDB)

Roback, Jennifer. “Wages, rents, and the quality of life,” *Journal of Political Economy*, 90(1982): 1257-1278. (EDB)

Mendelsohn, Robert, William Nordhaus and Daigee Shaw. “The impact of global warming on agriculture: A Ricardian analysis,” *American Economic Review*, 84(1994): 753-771. (EDB)

Schlenker, Wolfram, W. Michael Hanemann and Anthony Fisher. “Will U.S. Agriculture Really Benefit from Global Warming? Accounting for Irrigation in the Hedonic Approach,” *American Economic Review*, 95(2005): 395-406. (EDB)\*\*\*

Kuminoff, Nicolai V. and Jaren C. Pope, 2014. “Do ‘Capitalization Effects’ for Public Goods Reveal the Public’s Willingness to Pay?” *International Economic Review*, 55(4):1227-1250.



(EDB)

Deschenes, Olivier and Michael Greenstone. "The economic impacts of climate change: Evidence from agricultural output and random fluctuations in weather," *American Economic Review*, 97(2007): 354-385. (EDB)\*\*\*

Chay, Kenneth and Michael Greenstone. "Does air quality matter? Evidence from the housing market," *Journal of Political Economy*, 113(2005): 376-524. (EDB)\*\*\*

Smith, V. Kerry and Ju-Chin Huang. "Can markets value air quality? A meta analysis of hedonic property value models," *Journal of Political Economy*, 103(1995): 209-227. (EDB)

Bayer, Patrick, Nathaniel Keohane and Christopher Timmins. "Migration and hedonic valuation: The case of air quality," *Journal of Environmental Economics and Management*, 58:1(2009): 1-14. (EDB)

Muehlenbachs, Lucija, Elisheba Spiller and Christopher Timmins. "The housing market impacts of shale gas development," *American Economic Review*, 105:12(2015): 3633-3659. (EDB)

Kuminoff et al. "Best Practices for Property Value Models," *Review of Environmental Economics and Policy*, forthcoming. (MOOD)\*\*\*

## H. Valuing Mortality and Morbidity Risk

Freeman et al., Chapter 7. (BOOK) \*\*\*

Lee, Jonathan and Laura Taylor. "Randomized safety inspections and risk exposure on the job: Quasi-experimental estimates of the value of a statistical life," *AEJ: Economic Policy*. (MOOD) \*\*\*

Ashenfelter, Orley and Michael Greenstone. "Using mandatory speed limits to measure the value of a statistical life," *Journal of Political Economy*, 112(2004): S226-267. (EDB)

Agee, Mark and Thomas Crocker. "Parental and social valuations of child health information," *Journal of Public Economics*, 55(1994): 89-105. (EDB)

Taylor, Laura and Mary Evans. "Best Practices for Hedonic Wage Models," *Review of Environmental Economics and Policy*, forthcoming. (MOOD)\*\*\*

## I. Stated Preference Methods

Kling, Catherine L., Daniel J. Phaneuf, and Jinhua Zhao. "From Exxon to BP: Has some number become better than no number?" *Journal of Economic Perspectives* 26(2012): 3-26. (EDB)\*\*\*

Carson, Richard. "Contingent valuation: A practical alternative when prices aren't available," *Journal of Economic Perspectives* 26(2012): 27-42. (EDB)\*\*\*

Hausman, Jerry. "Contingent valuation: From dubious to hopeless," *Journal of Economic Perspectives* 26(2012): 43-36. (EDB)\*\*\*

Carson, Richard et al. "Contingent valuation and lost passive use value: Damages from the Exxon Valdez oil spill," *Environmental and Resource Economics*, 25(2003): 257-286. (EDB)\*\*\*

Boyle, Kevin. "Contingent valuation in practice," Chapter 4 in P.A. Champ et al. *A Primer on Nonmarket Valuation*, Kluwer Academic Publishers, Dordrecht, 2017. (MOOD)

Holmes, Thomas, Wiktor Adamowicz, Fredrik Carlsson. "Choice experiments," Chapter 5 in P.A. Champ et al. *A Primer on Nonmarket Valuation*, Kluwer Academic Publishers, Dordrecht, 2017. (MOOD)

Bishop, R et al. 2017. "Putting a value on injuries to natural assets: The BP oil spill," *Science*, 356(6335): 253-254. (EDB)\*\*\*

## **J. Combining Revealed and Stated Preference Data**

Cameron, Trudy. "Combining contingent valuation and travel cost data for the valuation of non-market goods," *Land Economics*, 68(1992): 302-317. (EDB)

von Haefen, Roger and Daniel Phaneuf. "Identifying demand parameters in the presence of unobservables: A combined revealed and stated preference approach," *Journal of Environmental Economics and Management*, 56(2008): 19-32. (EDB)\*\*\*

## **K. Misc. Valuation**

Rosenberger, Randall and John B. Loomis. "Benefit transfer," Chapter 11 in P.A. Champ et al. *A Primer on Nonmarket Valuation*, Kluwer Academic Publishers, Dordrecht, 2017. (MOOD)\*\*\*

## **L. Environmental Policy Design: Prices vs. Quantities and Hybrid Policies**

Weitzman, M. 1974. Prices vs. Quantities. *Review of Economic Studies* 41 :477-91.\*\*\*

Stavins, R. 1996, "Correlated Uncertainty and the Choice of Pollution Control Instruments," *Journal of Environmental Economics and Management* **30**: 218-232. \*\*\*

Roberts, M. and Spence, M. 1976. Effluent charges and licenses under uncertainty. *Journal of Public Economics*, 5: 193-208. \*\*\*

Rubin, Jonathan. 1996. A Model of Intertemporal Emission Trading, Banking and Borrowing. *Journal of Environmental Economics and Management*, 31(3): 269-286. \*\*\*

Newell, R. G. and W. A. Pizer. 2003. Regulating stock externalities under uncertainty. *Journal of Environmental Economics and Management*, 45(2): 416-432.

Hoel, M. and L. Karp. 2002. Taxes versus quotas for a stock pollutant. *Resource and Energy Economics*, 24: 367-384. \*\*\*

### **M. Environmental Policy Design: Performance Standards and Output Based Allocations**

Holland, S. P., J. E. Hughes, and C. R. Knittel. 2009. Greenhouse gas reductions under Low Carbon Fuel Standards? *American Economic Journal: Economic Policy*, 1(1):106-146. \*\*\*

Fell, H., D. Kaffine, and D. Steinberg. 2017. Energy Efficiency and Emissions Intensity Standards. *Journal of the Association of Environmental and Resource Economists*. 4(S1): S201-S226. \*\*\*

Fischer, C. 2009. Renewable Portfolio Standards: When do they lower energy prices? *The Energy Journal*. 30(4): 81-99. \*\*\*

Fell, H. and J. Linn. 2013. Renewable electricity policies, heterogeneity, and cost effectiveness. *Journal of Environmental Economics and Management*, 66(3): 688-707.

Fischer, C. and A.K. Fox. 2012. Comparing Policies to Combat Emissions Leakage: Border Carbon Adjustments Versus Rebates. *Journal of Environmental Economics and Management*. 64(2): 199-216.

### **N. Empirical Papers in Environmental and Energy Economics:**

#### Energy Demand, Conservation, and Energy Efficiency:

Fowle, Greenstone and Wolfram, 2018. "Do Energy Efficiency Investments Deliver? Evidence from the Weatherization Assistance Program." *Quarterly Journal of Economics*, 133(3):1597-1644.

Ito, K. and M. Tanaka, 2018. "Moral Suasion and Economic Incentives: Field Experimental Evidence from Energy Demand." *American Economic Journal: Economic Policy*, 10(1): 240-267

Davis, Lucas W., 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- 38.

Allcott, H. and T. Rodgers. 2014. "The Short-Run and Long-Run Effects of Behavioral Interventions: Experimental Evidence from Energy Conservation." *American Economic Review*, 104(10): 3003-3037.

Levinson, A. 2016. "How Much Energy Do Building Energy Codes Save? Evidence from California Houses." *American Economic Review*.

Novan, K., A. Smith, and T. Zhou. 2017. "Building Codes Do Save Energy: Evidence from Hourly Smart-Meter Data." Working Paper

([https://arefiles.ucdavis.edu/uploads/filer\\_public/f5/91/f591fb4a-2784-4099-8c26-6e44e87bb84e/building\\_code\\_draft\\_may2017.pdf](https://arefiles.ucdavis.edu/uploads/filer_public/f5/91/f591fb4a-2784-4099-8c26-6e44e87bb84e/building_code_draft_may2017.pdf)).

Health and the Environment:

Schlenker, Wolfram, and W. Reed Walker. 2016. Airports, Air Pollution, and Contemporaneous Health. *Review of Economic Studies*, 83 (2): 768–809.

Deschênes, Olivier, Michael Greenstone, and Joseph S. Shapiro. 2017. Defensive Investments and the Demand for Air Quality: Evidence from the NOx Budget Program. *American Economic Review*, 107(10): 2958–89.

Deryugina, T., G. Heutel, N.H. Miller, D. Moliter, and J. Reif. 2019. The Mortality and Medical Costs of Air Pollution: Evidence from Changes in Wind Direction. *American Economic Review*, 109(12):4178-4219.