

Applied Economics 8602
Economics of the Environment

SPRING 2013
B36 RUTTANH
11:45–1:00 TU TH

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Course Description.

THIS CLASS IS GOING TO BE DIFFERENT THAN IN THE PAST. It will be more contrarian and more skeptical. Since its last installment, in the fall of 2011, I've learnt or discovered some things that cause me to question whether many of the main findings in environmental economics, some of its most cherished conventional wisdoms, are correct. My plan is to invite you along on a journey of discovery in which we work together to figure out which of a series of prominent articles, some old and some new, stand up in the face of the surprising ideas I've come across. These are the two ideas:

1. **Curvature.** The standard assumptions regarding the shape of some crucial functions, most importantly that describing the benefits of abatement, might sometimes be violated. It is no longer clear to me that the marginal benefits to abatement of pollution must be declining in the level of abatement.
2. **Output effects.** Any analysis of pollution policy that is carried out entirely in the dimension of abatement levels, ignoring effects in the associated output market, can lead to incorrect answers.

The first comes from recent work by epidemiologists on the relationship between ambient particulate pollution and human health. For a long time, scientists were pretty sure that low levels of pollution concentration are safe for humans, but that high levels are dangerous. This means that the first unit of abatement confers high marginal benefit because health risks are reduced by quite a lot. Later units of abatement confer lower and lower marginal benefits. The newest science says that the first unit of *exposure* causes the greatest incremental health damage, and later units are less and less harmful at the margin. If this is correct, then the first unit of abatement confers low marginal benefit. Later units of abatement confer higher and higher marginal benefits. Similar problems might be possible for water pollution.

The second comes from my own new appreciation for the idea (which is widely accepted) of “windfall profits” associated with cap-and-trade programs to reduce emissions of greenhouse gases. The idea is that if valuable emissions allowances are given to polluters free of charge, the profits of the affected industry might actually rise above what they'd have been without the new and tighter environmental constraint. I have worked hard to understand the math of this phenomenon, when and how it can occur, and I now know that the key is to consider welfare effects in both the abatement domain and in the output domain. In great swaths of our literature, the output domain is ignored entirely. Because of this I'm not sure which of the important results in that literature are still correct when the output effects are considered.

The result of these two ideas or realizations is that my old way of teaching the class, in which I attempted to impart truth on a set of readings, is no longer satisfying to me. What's more, I don't think I could pull it off. I'm not a great actor, and if I'm not sure something is right I doubt I could convince you to believe it. My real suspicions would continually show through.

How the Course Used to Work

In the past, I've divided the course into two almost equal parts according to the main large themes in environmental economics: environmental policy analysis and nonmarket valuation. After some preliminary material, we would spend about half the course, the first half, studying policy. Then we would spend the other half studying nonmarket valuation. A variety of odds and ends filled in at the end. This is what I said about the course in the syllabus from 2011: "Each week we will take up a new topic, or perhaps two. There will be a set of readings for each topic. Students will be expected to have read the required readings for the week by Monday at class time. Most of our time will be devoted to lecture, but your active participation will be encouraged." The goal each week, through lecture and discussion, was reach an understanding of some important topic in the field. We were trying to learn the truth, as espoused in the published literature. A rough outline of topics went like this:

1. Background: welfare measurement
2. Background: market failure (externalities and public goods)
3. Pollution policy: taxes, permits, technology incentives
4. Policy for nonpoint pollution
5. Theory and methods of nonmarket valuation: contingent valuation, travel cost, hedonics
6. Value of a statistical life
7. Odds and ends: Option value and quasi-option value, the environmental Kuznets curve, climate change, valuing ecosystem services

How the Course Will Work This Time

I hope you'll find this new approach interesting, even invigorating. My goal is to take you to the frontier of environmental economics, and then to try, with your help, to push on the frontier. Maybe even to nudge it outward in a few places.¹

We will spend five weeks working through a series of papers that I think are especially ripe for a complete re-thinking. Thus, some of the old material will be thrown out, along with my prepared lecture notes. We will spend one session on the theory of public goods, but no time will be devoted to the measurement of welfare change. We reclaim a few weeks there. The treatment of nonmarket valuation will be shortened quite a bit. Because of the changes, I'm afraid the schedule included in this syllabus is more tentative than usual. I cannot tell how far we'll get.

In broad outlines, the course will progress as follows. First we'll build our foundation by studying the old received wisdom of environmental policy. That will occupy the first two weeks.

¹As I try to put myself in your place, I can imagine that this enterprise might create a little anxiety in some. It's strange and different. How will the exams work? What does it mean for future prelims? All I can say now is that I will work hard to be sure our exams are fair and reasonable, and that you will be given plenty of help in preparing for the prelim exam.

A two-week detour into climate change will give you time to prepare for what comes next, when we read a series of papers, one at a time, and work together to figure out if their results hold up in the face of (*i.*) increasing marginal benefits or (*ii.*) output effects or (*iii.*) both. After that comes a series of recent papers that we'll study one at a time, always asking how they might be improved. Finally, we'll turn briefly to nonmarket valuation and the value of a statistical life.

The introductory sessions will be in the traditional lecture mode, with discussion encouraged. After that we'll all read one article at a time, probably only one per week, with the deliberate goal of determining whether its main results are true if marginal benefits slope upward, or if the output effects are considered. We'll see whether the pace of one article per week is reasonable. Everyone will be expected to have read the paper carefully by Tuesday, when I'll lead a lecture-type discussion of the paper and how it works. Then in the Thursday session two of you will present your analysis of the paper, considering its soundness in the face of one of our two "violations." Five papers and ten students: each of you will get a turn leading one of these sessions.

Assigned Workload

This is another place where things are going to change from the past. We will have a series of mostly theoretical homeworks, and everyone will be required to take the mid-term exam. After that you have several choices. You can write an individual research paper. You can join a team, which I will lead, to work on a group research paper. You can take the final exam, which will be optional if you do a paper. Both paper projects are voluntary, but if you do neither then you *must* take the final exam. If you write a paper or join the group project, you *may* take the final exam too. Your presentation during the semester will also count in your grade.

The Group Research Paper

When I taught the course in Fall 2011, seven students volunteered to join a working group, which I led, to study the policy implications of an upward-sloping marginal benefit function. That experience was so rewarding, and the outcome so impressive, that I've decided to try to replicate it.² Early in the term I will describe one or more ideas for a research paper. These will be ideas that I think are both interesting and feasible, in the sense that a group of smart people working together for a few months can reasonably expect to complete a paper for submission to a journal. You will be asked early to decide whether to join the working group. Those who join will be expected to meet weekly through the remainder of the semester, and each will be expected to contribute significantly to the project, most likely in pairs or threesomes. If this exercise works like it did the last time, it will be a great way to learn how the research process works in practice, all the way from choosing a topic, to deciding how to model the problem, to proving results (if theoretical) or obtaining data and executing an empirical strategy, to writing the paper. But remember: this project is voluntary.

The Individual Research Paper

If you prefer to work on a paper by yourself, you can do that rather than join the group project. If you choose this option, before the end of the fourth week of the semester (by February 14) those

²The resulting paper, Goodkind *et al.* (2012), is on our syllabus.

choosing this option will be required to: 1) talk with me about your ideas for the paper; and 2) submit a two-page prospectus describing your plan. This document is to provide an overview of the problem that you intend to study and a sketch of the methods and possibly the data you will use. The paper itself will be due at classtime on Thursday, May 2. (This deadline is firm.) More details about the paper project will be contained in a separate handout.

Grading

Because of the experimental nature of this course, I plan to be more lenient in grading than usual. I want to be sure not to inject additional anxiety over grades. Still, the rules require that I assess your performance and issue grades, so here is how that will work. Your grade will be determined using the following weights, depending on your choice about the final exam and the paper:

	Option 1 Final exam	Option 2 Joint paper	Option 3 Indiv Paper	Option 4 Final & paper
Homeworks	30 %	25 %	25 %	20 %
Paper	– 0 –	25 %	25 %	20 %
Mid-term exam	30 %	40 %	40 %	25 %
Final exam	30 %	– 0 –	– 0 –	25 %
Class participation	10 %	10 %	10 %	10 %

The grade for an individual paper will be assessed according to my judgment of quality, with scores ranging up to 100 for an ideal specimen. The grade for participation on the joint paper will be binary: either 90 if my assessment is that your contribution was not adequate; or 100 if my assessment is that your contribution was adequate. My expectation is that all who participate will get a grade of 100. (I worry more that, given the competitive nature of most graduate students, people will work *too hard* on the project.) Final grades will be calculated on a curve, using these weights. Plus and minus grades will be used, with scoring based on the following table:

Weighted Average	Final Grade	Weighted Average	Final Grade
93–100	A	83–86.9	B
90–92.9	A–	80–82.9	B–
87–89.9	B+	–79.9	C

University Grading Standards

I will follow the *University Grading Standards*, found on the web at policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.html.

Books and other readings.

The readings for the course will be taken mostly from published articles. You will also benefit from buying two books.

1. Freeman III, A. Myrick, *The Measurement of Environmental and Resource Values: Theory and Methods*, Second edition, (Washington D.C.: Resources for the Future, 2003).
2. Haab and McConnell, *Valuing Environmental and Natural Resources: The Econometrics of Non-Market Valuation*, (Northampton, MA: Edward Elgar, 2002).

All readings not found in the texts will be available at the University library's online reserve. The web address is eres.lib.umn.edu/eres/coursepage.aspx?cid=2239. I will provide you with the class password needed to log into the site.

Two blogs by environmental economists that I find interesting are *An Economic View of the Environment* by Rob Stavins (go to belfercenter.ksg.harvard.edu/analysis/stavins) and *Environmental Economics* by Tim Haab and John Whitehead (go to www.env-econ.net). I will refer to these and other bloggy sources from time to time and you should plan to visit them too.

Final Exam

The time for the final, in case anyone chooses to take it, is listed as 8:00am–10:00am Saturday, May 18. I will be willing to offer the exam at other times according to your schedules.

COURSE SCHEDULE

Week	Topic	Required Readings
1: Jan 22 Jan 24	Introduction: Output effects More on output effects	Montgomery 1972 Buchanan and Tullock 1975
2: Jan 29 Jan 31	Introduction: Curvature More on curvature	Weitzman 1974 Goodkind <i>et al.</i> 2012; Marshall <i>et al.</i> 2012
3: Feb 5 Feb 7	Climate change: fat tails Against fat tails	Weitzman 2009 McKittrick 2012; Horowitz-Lange 2009
4: Feb 12 Feb 14	Public goods Climate change: geoengineering	Laffont, ch. 2 Weitzman 2012
5: Feb 19–21	Permits and market power	Hahn 1984; Meunier 2011
6: Feb 26–28	Technology adoption	Requate-Unold 2003
7: Mar 5–7	Water-quality trading	Farrow <i>et al.</i> 2005; Konishi <i>et al.</i> 2012
8: Mar 12	Nonpoint pollution	Hansen 2002; Segerson 1988
Mar 14	Mid-term exam	
9: Mar 26–28	Permits and market manipulation	Stocking 2012
10: Apr 2	Efficient pollution regulation	Muller and Mendelsohn 2009
Apr 4	Multiple cities and sources	Goodkind and Coggins 2012
11: Apr 9	Env Accounting for Pollution	Muller <i>et al.</i> 2011
Apr 11	Ecosystem services (S. Polasky)	Polasky and Segerson 2009
12: Apr 16	Emissions trading and hot spots	Antweiler 2012
Apr 18	Water-quality trading	Horan and Shortle 2011
13: Apr 23	Contingent valuation	Haab and McConnell, chs. 2–4
14: Apr 30	Hedonics	Haab and McConnell, ch. 9; Albouy <i>et al.</i>
15: May 7	Value of a life	Ashenfelter; Shogren and Stamland

COURSE OUTLINE AND READINGS

(Required readings in red)

Session 1, January 22: Introduction: Output effects

1. Montgomery, W. David, "Markets in Licenses and Efficient Pollution Control Programs," *Journal of Economic Theory*, 5 (1972), 395–418.
2. Stavins, Robert N., "Experience with Market-Based Environmental Policy Instruments," in G. Mäler and J. Vincent, eds., *Handbook of Environmental Economics*, (New York: Elsevier, 2003).
3. Krupnick, Alan J., Wallace E. Oates, and Eric Van De Verg, "On Marketable Air-Pollution Permits: The Case for a System of Pollution Offsets," *Journal of Environmental Economics and Management*, 10 (1983), 233–247.
4. Porter, Michael E. and Claas van der Linde, "Toward a New Conception of the Environment-Competitiveness Relationship," *Journal of Economic Perspectives*, 9:4 (1995), 97–118.
5. Palmer, Karen, Wallace E. Oates, and Paul R. Portney, "Tightening Environmental Standards: The Benefit-Cost or the No-Cost Paradigm?" *Journal of Economic Perspectives*, 9:4 (1995), 119–132.

Session 2, January 24: More on output effects

1. Buchanan, James M. and Gordon Tullock, "Polluters' Profits and Political Response: Direct Controls versus Taxes," *American Economic Review*, 65 (1975), 139–147.
2. Yohe, Gary W., "Polluters' Profits and Political Response: Direct Controls versus Taxes: Comment," *American Economic Review*, 66 (1976), 981–982.

Session 3, January 29: Introduction: Curvature

1. Weitzman, Martin, "Prices vs. Quantities," *Review of Economic Studies*, 41 (1974), 477–491.
2. Baumol, William J. and Wallace E. Oates, *The Theory of Environmental Policy*, 2nd edition, (Cambridge: Cambridge University Press), ch. 5.

Session 4, January 29: More on curvature

1. Marshall, Julian D., Joshua S. Apte, Jay S. Coggins, Andrew L. Goodkind, "Blue Skies Bluer?" mimeo, University of Minnesota, December 2012.
2. Goodkind, Andrew L., Jay S. Coggins, Timothy A. Delbridge, Milda Irhamni, Justin Andrew Johnson, Suhyun Jung, Julian D. Marshall, Bijie Ren, Martha H. Rogers, and Joshua S. Apte, "Prices vs. Quantities With Increasing Marginal Benefits," mimeo, University of Minnesota, November 2012.
3. Krewski, Daniel, Michael Jerrett, Richard T. Burnett, Renjun Ma, Edward Hughes, Yuanli Shi, Michelle C. Turner, C. Arden Pope III, George Thurston, Eugenia E. Calle, and Michael J. Thun, *Extended Follow-Up and Spatial Analysis of the American Cancer Society Study Linking Particulate Air Pollution and Mortality*, (Boston: Health Effects Institute, 2009). pp. 5–31.

Session 5, February 5: Climate change: Fat tails

1. Weitzman, Martin L., ‘On Modeling and Interpreting the Economics of Catastrophic Climate Change,’ *Review of Economics and Statistics*, 91 (2009), 1–19.

Session 6, February 7: Against fat tails

1. McKittrick, Ross, “Cheering Up the Dismal Theorem,” mimeo, University of Guelph, 2012.
2. Horowitz, John and Andreas Lange, “What’s Wrong With Infinity—A Note on Weitzman’s Dismal Theorem,” mimeo, University of Maryland, 2009.
3. Weitzman, Martin L., “GHG Targets as Insurance Against Catastrophic Climate Damages,” *Journal of Public Economic Theory*, 14 (2012), 221–244.
4. Costello, Christopher J., Michael G. Neubert, Stephen A. Polasky, and Andrew R. Solow, “Bounded Uncertainty and Climate Change Economics,” *Proceedings of the National Academy of Sciences*, 107 (2010), 8108–8110.

Session 7, February 12: Public goods

1. Laffont, Jean-Jacques, *Fundamentals of Public Economics*, (Cambridge, MA: MIT Press, 1988), ch. 2.

Session 8, February 14: Climate change: geoengineering

1. Weitzman, Martin, “A Voting Architecture for the Governance of Free-Driver Externalities, with Application to Geoengineering,” NBER Working Paper No. 18622, December 2012.

Sessions 9–10, February 19 & 21: Permits and market power

1. Hahn, Robert W., “Market Power and Transferable Property Rights,” *Quarterly Journal of Economics*, 99 (1984), 753–765.
2. Meunier, Guy, “Emission Permit Trading Between Imperfectly Competitive Product Markets,” *Environmental and Resource Economics*, 50 (2011), 347364.

Sessions 11–12, February 26 & 28: Technology adoption

1. Requate, Till and Wolfram Unold, “Environmental Policy Incentives to Adopt Advanced Abatement Technology: Will the True Ranking Please Stand Up?” *European Economic Review*, 47 (2003), 125–146.
2. Fischer, Carolyn, Ian W.H. Parry, and William A. Pizer, “Instrument Choice for Environmental Protection When Technological Innovation is Endogenous,” *Journal of Environmental Economics and Management*, 45 (2003) 523–545.

Sessions 13–14, March 5 & 7: Water-quality trading

1. Farrow, R. Scott, Martin T. Schultz, Pinar Celikkol, and George L. Van Houtven, “Pollution Trading in Water Quality Limited Areas: Use of Benefits Assessment and Cost-Effective Trading Ratios,” *Land Economics*, 81 (2005), 191–205.

2. Konishi, Yoshifumi, Jay S. Coggins, and Bin Wang, “Water Quality Trading: Can We Get the Prices of Pollution Right?” mimeo, Sophia University, 2012.

Session 15, March 12: Nonpoint pollution

1. Hansen, Lars Garn, “Regulation of Non-Point Emissions,” *Environmental and Resource Economics*, 21 (2002), 303–316.
2. Segerson, Kathy, “Uncertainty and Incentives for Nonpoint Pollution Control,” *Journal of Environmental Economics and Management*, 15 (1988), 87–98.

Session 16, March 14: Mid-term exam

Sessions 17–18, March 26 & 28: Permit and market manipulation

1. Stocking, Andrew, “Unintended Consequences of Price Controls: An Application to Allowancem Mrkets,” *Journal of Environmental Economics and Management*, 63 (2012), 120–136.

Session 19, April 2: Efficient pollution regulation

1. Muller, Nocholas Z. and Robert Mendelsohn, “Efficient Pollution Regulation: Getting the Prices Right,” *American Economic Review*, 99 (2009), 1714–1739.

Session 20, April 4: Multiple cities and sources

1. Goodkind, Andrew L. and Jay S. Coggins, “Comparison of Pollution Abatement Policies with Krewski Dose-Response Functions: Multiple Cities and Sources Model,” mimeo, University of Minnesota, 2012.

Session 21, April 9: Environmental accounting for pollution

1. Muller, Nicholas Z., Robert Mendelsohn, and William Nordhaus, “Environmental Accounting for Pollution in the United States Economy,” *American Economic Review*, 101 (2011), 1649–1675.

Session 22, April 11: Ecosystem services (Steve Polasky)

1. Polasky, Stephen and Kathleen Segerson, “Integrating Ecology and Economics in the Study of Ecosystem Services: Some Lessons Learned,” *Annual Review of Resource Economics*, 1 (2009), 409–434.

Session 23, April 16: Emissions trading and hot spots

1. Antweiler, Werner, “Emission Trading for Air Pollution Hot Spots: Getting the Permit Market Right,” mimeo, University of British Columbia, 2012.

Session 24, April 18: Water-quality trading

1. Horan, Richard D. and James S. Shortle, “Economic and Ecological Rules for Water Quality Trading,” *Journal of the American Water Resources Association*, 47 (2011), 59–69.

Sessions 25–26, April 23 & 25: Contingent valuation

1. Haab, Timothy and Ted McConnell, *Valuing Environmental and Natural Resources: The Econometrics of Non-Market Valuation*, (Northampton, MA: Edward Elgar, 2002), chs. 2–4.
2. Freeman III, A. Myrick, *The Measurement of Environmental and Resource Values: Theory and Methods*, Second edition, (Washington D.C.: Resources for the Future, 2003), ch. 6.
3. Carson, Richard T. and Hanemann, W. Michael, “Contingent Valuation,” *Handbook of Environmental Economics*, in K. G. Mäler and J. R. Vincent (ed.), (New York: Elsevier, 2005).

Sessions 27–28, April 30 & May 2: Hedonics

1. Haab, Timothy and Ted McConnell, *Valuing Environmental and Natural Resources: The Econometrics of Non-Market Valuation*, (Northampton, MA: Edward Elgar, 2002), ch. 9.
2. Albouy, David, Walter Graf, Ryan Kellogg, and Hendrik Wolff, “Climate Amenities, Climate Change, and American Quality of Life,” mimeo, University of Michigan, 2011.
3. Freeman III, A. Myrick, *The Measurement of Environmental and Resource Values: Theory and Methods*, Second edition, (Washington D.C.: Resources for the Future, 2003), ch. 11.

Sessions 29–30, May 7 & 9: Value of a life

1. Ashenfelter, Orley, “Measuring the Value of a Statistical Life: Problems and Prospects,” *Economic Journal*, 116 (2006), C10–C23.
2. Shogren, Jason F. and Tommy Stamland, “Skill and the Value of Life,” *Journal of Political Economy*, 110 (2002), 1168–1173.