

## ECON 2687 Advanced Economics of the Environment, Natural Resources, and Climate Change

Harvard University, Fall 2022, half course / 2 credits

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Professor: [Bard Harstad](#), E-mail: [bard.harstad@econ.uio.no](mailto:bard.harstad@econ.uio.no)

Syllabus date: 11/17 (to be updated). [Click here for the most up-to date syllabus](#).

Credit: Problem set (see below). + 3h exam OR a 5-12p. term paper using related methods.

Lectures:	Time	Room
	Tuesday 10/11, 3:00-5:30:	Littauer M-16.
	Tuesday 10/18, 3:00-5:30:	Sever 208.
	Thursday 10/20, 3:00-4:15:	Littauer M-17.
	Tuesday 10/25, 3:00-5:30:	Sever 208.
	<b>Problem Set: handed out 10/25; return by 11/12.</b>	
	Tuesday 11/15, 3:00-5:30:	Sever 208.
	Thursday 11/17, 3:00-4:15:	Littauer M-17.
	Tuesday 11/22, 3:00-5:30:	Sever 208.

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In this half-course, we start with the basic lessons in environmental economics before you learn modern tools, methods, and models in climate change economics.

The plan is to offer a second half-course in the Spring of 2023 (focusing more on conservation, deforestation, and political economics). Students are free to take either one (or both) of the two half-courses.

This course draws on microeconomic tools, such as dynamic game theory, and offers a coherent framework that can be used to analyze environmental problems as well as solutions. The models are especially relevant to study climate policies and agreements. We will model countries' strategic choices of emissions over time, their investments in technology, alternative designs of agreements, free riding, coalition formation, and compliance. Because the problem is dynamic, it is important to think carefully about discounting and time inconsistency.

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The material will draw on a large literature (see next page) but most of the lectures are summarized in [Lecture Note 1](#), [Lecture Note 2](#), [Lecture Note 3](#), and [Lecture Note 4](#) (these versions, from 2021, will be updated slightly in September).

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1. Environmental Problems: Welfare theorems, market failures, Coase, Pigou, tradable permits
2. International problems: Business as usual (no agreement)
3. Agreements : Legally binding agreements
4. Coalitions: Free riding vs. participation
5. Compliance: Self-enforcing agreements
6. Comparisons: Kyoto vs. Paris
7. The Future: Discounting, political economics, and time inconsistency

### **Useful Background:**

Mas-Colell, Whinston, and Green (1995): *Microeconomic Theory* (Ch. 7-11), Fudenberg and Tirole (1996): *Game Theory* (Ch. 3-5 and 13), or something similar.

### **Reading List:**

Most of the required reading will be based on lecture notes, such as [Lecture Note 1](#), [Lecture Note 2](#), [Lecture Note 3](#), and [Lecture Note 4](#). These will be substantially updated before class. In addition, we will draw on a number of articles that can also serve as a reference list.

#### **1. Environmental Problems: Welfare theorems, market failures, Coase, Pigou, tradable permits**

Coase, R. H. (1960): "The Problem of Social Cost," *J. Law and Econ.* 3:1–44.

Montgomery, W.D. (1972): "Markets in licenses and efficient pollution control programs," *Journal of Economic Theory* 5 (3), 395–418.

Weitzman, Martin L. (1974): "Prices vs. Quantities," *Review of Economic Studies* 41(4): 477-91.

#### **2. International problems: Business as usual (no agreement)**

##### **Lecture Note 1** (Sections 1-3)

Acemoglu, D., P. Aghion, L. Bursztyn, and D. Hemous (2012): "The Environment and Directed Technical Change," *American Economic Review* 102(1): 131-66

Golombek, R., and M. Hoel (2005): "Climate Policy under Technology Spillovers," *Environmental and Resource Economics* 31(2): 201-27.

Harstad, B. (2012): "Climate Contracts: A Game of Emissions, Investments, Negotiations, and Renegotiations," *Review of Economic Studies* 79(4): 1527-57.

Jaffe, A.B., R.G. Newell and R.N. Stavins (2003): "Technological Change and the Environment," in Mäler, K.-G. and Vincent, J.R., *Handbook of Environmental Economics* 1: 461-516.

Kolstad, C. D., and M. Toman (2005): "The Economics of Climate Policy," *Handbook of Environmental Economics* 3: 1562-93.

Levhari, D. and L. J. Mirman (1980): "The Great Fish War: An Example Using Nash-Cournot Solution," *Bell Journal of Economics* 11: 322--334.

Newell, R.G., A.B. Jaffe and R.N. Stavins (2006): "The Effects of Economic and Policy Incentives on Carbon Mitigation Technologies," *Energy Economics* 28: 563-78.

Ploeg, F.V.D., and A. de Zeeuw (1992): "International aspects of pollution control," *Environmental and Resource Economics* 2(2): 117-39.

#### **3. Agreements**

##### **Lecture Note 1** (Continues: Sections 4-7)

Barrett, S. (1994): "Self-enforcing international environmental agreements," *Oxford Economic Papers* 46: 878-94.

Barrett, S. (2002): "Consensus Treaties," *Journal of Institutional and Theoretical Politics* 158: 519--41.

- Barrett, S. (2005): "The Theory of International Environmental Agreements," Ch. 28 in Mäler, K.-G. and Vincent, J.R., *Handbook of Environmental Economics* 3: 1457-1516.
- Beccherle, J., and J. Tirole (2011): "Regional Initiatives and the Cost of Delaying Binding Climate Change Agreements," *Journal of Public Economics* 95(10-11): 1339-48.
- Buchholz, W., and K. Konrad (1994): "Global Environmental Problems and the Strategic Choice of Technology," *Journal of Economics* 60(3): 299-321.
- Calvo, E., and S. Rubio (2013): "Dynamic Models of International Environmental Agreements: A Differential Game Approach," *International Review of Environmental and Resource Economics* 6(4): 289-339.
- Dutta, Prajit K. and R. Radner (2009): "A Strategic Analysis of Global Warming: Theory and Some Numbers," *Journal of Economic Behavior & Organization* 71(2): 187-209.
- Harstad, B. (2016): "The Dynamics of Climate Agreements," *Journal of the European Economic Association* 14(3): 719-52.
- Hong, F. and Karp, L. (2012): "International Environmental Agreements with Mixed Strategies and Investment," *Journal of Public Economics* 96(9-10): 685-97.

#### **4. Coalitions: Free Riding vs. Participation**

##### **Lecture Note 2**

- Battaglini, M., and B. Harstad (2016): "Participation and Duration of Environmental Agreements," *Journal of Political Economy* 124(1): 160-204.
- Bhaskar, D. and H. Vartiainen (2020): Coalition formation and history dependence, *Theoretical Economics* 15: 159-197.
- Carraro, C., and D. Siniscalco (1993): "Strategies for the international protection of the environment," *Journal of Public Economics* 52(3): 309-28.
- Dixit, A., and M. Olson (2000): "Does voluntary participation undermine the Coase Theorem?" *Journal of Public Economics* 76(3): 309-35.
- Nordhaus, W. D. (2015): "Climate Clubs: Overcoming Free-riding in International Climate Policy," *American Economic Review* 105(4): 1339-70.
- Rey, D. and R. Vohra (2001): "Coalitional Power and Public Goods," *Journal of Political Economy* 109 (6): 1355-84.
- Rey, D. and R. Vohra (2015), "Coalition formation," *In Handbook of Game Theory* (Shmuel Zamir and Petyon Young, eds.): 239–326.
- de Zeeuw, A. (2008): "Dynamic effects on the stability of international environmental agreements," *Journal of Environmental Economics and Management* 55(2): 163--74.

#### **5. Compliance and Self-enforcing Agreements**

##### **Lecture Note 3**

- Barrett, S. (1994). "Self-Enforcing International Environmental Agreements." *Oxford Economic Papers*, 46, 878–894.
- Barrett, S. (2003): *Environment & Statecraft: The Strategy of Environmental Treaty-Making*, Oxford University Press.
- Dutta, P. K., and R. Radner (2004): "Self-enforcing climate-change treaties," *PNAS* 101: 4746-51.

Harstad, B., F. Lancia and A. Russo (2019): "Compliance Technology and Self-Enforcing Agreements," *Journal of the European Economic Association* 17(1):1-30.

Harstad, B., F. Lancia, and A. Russo (2022): "Prices vs. Quantities for Self-Enforcing Agreements," *Journal of Environmental Economics and Management* 111 (January).

## 6. Comparison: Kyoto vs. Paris

Bodansky, D., and L. Rajamani (2018): "The Evolution and Governance Architecture of the United Nations Climate Change Regime," in *Global Climate Policy: Actors, Concepts, and Enduring Challenges*, ed. by U. Luterbacher and D. Sprinz, MIT Press.

Eichner, T., and M. Schopf (2022): "Self-enforcing climate agreements: Kyoto versus Paris," mimeo, University of Hagen.

Finus, M., and S. Maus (2008): "Modesty May Pay," *Journal of Public Economic Theory* 10(5): 801-26.

Harstad, B. (2023): "Pledge-and-Review Bargaining: From Kyoto to Paris," *Economic Journal*, forthcoming.

## 7. Discounting and Time Inconsistency

### [Lecture Note 4](#)

Bisin, A., A. Lizzeri, and L. Yariv (2015): "Government Policy with Time Inconsistent Voters." *American Economic Review* 105(6): 1711–37.

Dengler, S., R. Gerlag, S.T. Trautmann, and G. Kuilen (2018): "Climate Policy Commitment Devices". *Journal of Environmental Economics and Management* 92:331-42.

Galperti, S., and B. Strulovici (2017): "A Theory of Intergenerational Altruism." *Econometrica* 85 (4): 1175–218.

Gerlagh, R., and M. Liski (2018): "Consistent Climate Policies." *Journal of the European Economic Association* 16(1): 1–44.

Giglio, S., M. Maggiori, and J. Stroebe (2015): "Very Long-Run Discount Rates." *Quarterly Journal of Economics* 130(1): 1–53.

Gollier, C., and M. L. Weitzman (2010): "How Should the Distant Future Be Discounted When Discount Rates Are Uncertain?" *Economic Letters* 107(3): 350–53.

Gollier, C., and R. Zeckhauser (2005): "Aggregation of Heterogeneous Time Preferences." *Journal of Political Economy* 113(4): 878–96.

Gul, F., and W. Pesendorfer (2001): "Temptation and Self-Control." *Econometrica* 69(6): 1403–35.

Harstad, B. (2020): "Technology and Time Inconsistency," *Journal of Political Economy* 128(7), 2020: 2653-89.

Jackson, M.O., and L. Yariv (2015): "Collective Dynamic Choice: The Necessity of Time Inconsistency." *American Economic Journal: Microeconomics* 7(4): 150-78.

Karp, L. (2005): "Global Warming and Hyperbolic Discounting." *Journal of Public Economics* 89: 261-82.

Krusell, P, B. Kurusçu, and A.A. Smith Jr (2010): "Temptation and Taxation." *Econometrica* 78(6): 2063-84.

Laibson, D. (1997): "Golden eggs and hyperbolic discounting." *Quarterly Journal of Economics* 112(2): 443-78.

Saez-Marti, M., and J. W. Weibull (2005): "Discounting and altruism to future decision-makers." *Journal of Economic Theory* 122: 254-66.

Strotz, R.H. (1956): "Myopia and Inconsistency in Dynamic Utility Maximization." *Review of Economic Studies* 23: 166-80.

Weitzman, M. L. (1998): "Why the Far-Distant Future Should Be Discounted at Its Lowest Possible Rate," *Journal of Environmental Economics and Management*, 36(3): 201-208.

Weitzman, M.L. (2001): "Gamma Discounting." *American Economic Review* 91(1): 260-71.

**Relevant Books:**

Barrett, S. (2003): *Environment & Statecraft: The Strategy of Environmental Treaty-Making*, Oxford University Press.

Phaneuf, D.J., and T. Requate (2016): *A Course in Environmental Economics: Theory, Policy, and Practice*, Cambridge University Press.