

ECON9912C: Dynamic Games in Environmental Economics

Professor:	Bård Harstad
What:	Ph.D minicourse (14h/3ECTS credits).
When:	May 26-28, 2021.
Who:	Open for all, also external/international students/scholars.
Where:	Lectures will be at UiO, but can be followed on Zoom.
How:	Take-home exam or term paper.
Sign up:	https://www.uio.no/studier/emner/sv/oekonomi/ECON9912C/v21
Syllabus date:	April 6, 2021.

This PhD minicourse applies dynamic game theory and offers a coherent framework that can be used to analyze environmental problems as well as solutions. We will model countries' strategic choices of emissions over time, their investments in technology, bargaining and alternative designs of agreements, and free riding and coalition formation. We will also compare policy instruments, such as demand-side and supply-side regulation. Because the problem is dynamic, it is important to think carefully about discounting and time inconsistency. We will end by analyzing the political economics of environmental regulation.

The material will draw on a large literature (see next page) but the first parts are summarized in **Lecture Note 1**, **Lecture Note 2**, and **Lecture Note 3** (all will be updated). The lectures will be taught and recorded at the University of Oslo, but it will run on Zoom and be available also for external students, whether they would like to follow online or in person. There will be six lectures (14h) and a take-home exam or term paper for those who want credit for the class.

1. Dynamic Games:	Fossil Fuel Emission vs. Investments in Technology
2. Negotiations:	Incomplete Contracts vs. Self-enforcing Agreements
3. Coalitions:	Free Riding vs. Participation
4. Instruments:	Demand-side vs. Supply-side Regulation
5. Discounting:	Long-term planning vs. Time Inconsistency
6. Political Economics:	The Politics vs. the Economics of Environmental Regulation

Required 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](#), and [Lecture Note 3](#). 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. Dynamic Games: Fossil Fuel Emission vs. Investments in Technology**Lecture Note 1**

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.

2. Negotiations: Incomplete Contracts vs. Self-enforcing Agreements**Lecture Note 2**

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, P. K., and R. Radner (2004): "Self-enforcing climate-change treaties," *PNAS* 101: 4746-51.
- 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.
- Harstad, B., F. Lancia and A. Russo (2019): "Compliance Technology and Self-Enforcing Agreements," *Journal of the European Economic Association* 17(1):1-30.
- Hong, F. and Karp, L. (2012): "International Environmental Agreements with Mixed Strategies and Investment," *Journal of Public Economics* 96(9-10): 685-97.

3. Coalitions: Free Riding vs. Participation

[Lecture Note 3](#)

- 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.
- Bloch, F. (2018): "Coalitions and networks in oligopolies," *Handbook of Game Theory and Industrial Organization*, ed. by L. Corchon and M. Marini, Edward Elgar.
- 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.

4. Instruments: Demand-side vs. Supply-side Regulation

Bohm, P. (1993): "Incomplete International Cooperation to Reduce CO2 Emissions: Alternative Policies," *Journal of Environmental Economics and Management* 24(3): 258-71.

Elliott, J., I. Foster, S. Kortum, T. Munson, Todd, F.P. Cervantes and D. Weisbach (2010): "Trade and Carbon Taxes," *American Economic Review: Papers & Proceedings* 100(May): 465-9.

Gerlagh, R. and M. Liski (2011): "Strategic Resource Dependence," *Journal of Economic Theory* 146(2): 699-727.

Harstad, B. (2012): "Buy Coal! A Case for Supply-Side Environmental Policy," *Journal of Political Economy* 120(1): 77-115.

Harstad, B. (2016): "The Market for Conservation and Other Hostages," *Journal of Economic Theory* 166(Nov): 124-51.

Harstad, B. and T. Mideksa (2017): "Conservation Contracts and Political Regimes" *Review of Economic Studies* 84(4): 1708-34.

Hoel, M. (1994): "Efficient Climate Policy in the Presence of Free Riders." *J. Environmental Econ. And Management* 27(3): 259--74.

Markusen, James R. (1975): "International externalities and optimal tax structures," *Journal of International Economics* 5(1): 15-29.

Sinn, H.W. (2008): "International externalities and optimal tax structures," *Journal of International Economics* 5(1): 15-29.

5. Discounting: Long-term Planning vs. Time Inconsistency

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. Stroebel (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. Kuruşçu, 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.

6. Political Economics: The Politics vs. the Economics of Environmental Regulation

- Austen-Smith, D., B. Harstad, W. Dziuda and A. Loeper (2019): "Gridlock and Inefficient Policy Instruments" *Theoretical Economics* 14(4): 1483–1534.
- Bang, G., J. Hovi, and D.F. Sprinz (2012): "US Presidents and the Failure to Ratify Multilateral Environmental Agreements." *Climate Policy* 12(6): 755–63.
- Battaglini, M., and Harstad, B. (2020): "The Political Economy of Weak Treaties," *Journal of Political Economy* 128(2): 544–90.
- Buchholz, W., A. Haupt, and W. Peters (2005): "International Environmental Agreements and Strategic Voting." *Scandinavian Journal of Economics* 107(1): 175–95.
- Dietz, S., C. Marchiori, and A. Tavoni (2012): "Domestic Politics and the Formation of International Environmental Agreements." Working Paper no. 100, *Centre Climate Change Economics and Policy*.
- Harstad, B. (2008): "Do Side Payments Help? Collective Decisions and Strategic Delegation." *Journal of the European Economic Association* 6(2–3): 468–77.

Hovi, J., D.F. Sprinz, and G. Bang (2012): "Why the United States Did Not Become a Party to the Kyoto Protocol: German, Norwegian and U.S. Perspectives." *European Journal of International Relations* 18: 129–50.

Maggi, G., and M. Morelli (2006): "Self-Enforcing Voting in International Organizations." *American Economic Review* 96(4): 1137–58.

Segendorff, B. (1998): "Delegation and Threat in Bargaining." *Games and Economic Behavior* 23(2): 266-83.

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.

