

Economics 443: The Economics of Climate Change

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Office hours: Wednesdays 10–11:30pm or by appointment

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course website: <http://qed.econ.queensu.ca/pub/faculty/garvie/econ443/443home.html>

Climate change is arguably the most complex and pressing environmental problem facing the global community today. At root, climate change is a result of the externality associated with greenhouse gas emissions. Unlike the classic pollution externality problem commonly studied in economics courses, climate change has a number of unique features which distinguishes it from other externalities. First and foremost, it is global in its causes and consequences. Second, the impacts of climate change are large, long-term and persistent. Third, uncertainties and risks in the economic impacts are pervasive. Finally, there is a serious risk of major, irreversible change with non-marginal economic effects. These features shape the economic analysis of climate change: it must be global, deal with long time horizons, have the economics of risk and uncertainty at its core, and examine the possibility of major, non-marginal changes.

Course in Brief (approximate times)

- I. Introduction and background (1 week)
 - A. Science of climate change
 - B. Impacts of climate change (Student PowerPoint presentations)
 - C. What did we learn from the science?
- II. Economic approach to valuing climate change (½-1 week)
- III. Aggregating climate change damages across space, time and risk (2-2½ weeks)
- IV. The *Stern Review* (1½ weeks)
 - a. Estimating climate change damages
 - b. *Stern Review* Debate (Student PowerPoint presentations)
- V. Economics of stabilisation (3-3½ weeks)
 - A. Flow and stock pollution models
 - B. Stabilisation Wedges Game (Student PowerPoint presentations)
 - C. Least-cost pollution control
- VI. Policy responses to mitigation and adaptation (2-2½ weeks)
- VII. International collective action (if time permits)

Course Requirements and Evaluation (Tentative Dates)

Two 40 minute midterms (4 th and 8 th week of term)	30%
Group learning activities	
Impacts of climate change (Mon, Sept 16th)	4%
<i>Stern Review</i> Debate (Wed, Oct 16th)	10%
<i>Stabilization Wedges</i> Game (first half November)	10%
Climate Policy Game (final class, if time permits)	6%
Final examination	40%

Group Learning Activities

Grading will be a combination of instructor, peer and self assessment. A grade of zero will be assigned to a student who does not participate in a group learning activity. Details on learning activities will be provided in advance of these classes.

Impacts of climate change

The class will be divided into small groups. Groups will present and hand-in a 6-7 minute PowerPoint presentation on a pre-assigned impact category. See section I.B. on the Reading List for readings. Impact categories include:

1. Global social systems
2. Regional social systems
3. Biological systems
4. Geophysical systems
5. Extreme events

Stern Review Debate

The class will be divided into 2-3 critic groups. Critic assignments will be announced on a first-come-first-serve basis. Groups will present and hand-in a 15-20 minute PowerPoint presentation which presents their critic's viewpoint, the *Stern Review* team's response to the critic, including any rebuttals, and a critical assessment of the debate.

Stabilization Wedges Game

A class will be devoted to the *Stabilization Wedges Game*, developed by Pacala and Socolow at Princeton University. Prior to the presentation class, country assignments and groups will be determined. Each group must meet to determine the best stabilization wedge strategy considering the following factors for their country: economic, energy demand, environmental, policy, equity, mobility, implementation and technology issues. Groups will present and hand-in a 15-20 minute PowerPoint presentation summarizing their country wedge strategy. Each team will be judged on its ability to defend its portfolio of strategies, considering both capacity constraints and economic impacts of each technology.

Climate Policy Game TBA

If this learning activity is cancelled, the grade will be redistributed to the final exam and other learning activities.

Attendance

This course is NOT a textbook course hence successful completion of the course requires attending lectures. Any lecture material posted on the course website does NOT fully represent material covered in lecture. If you miss a lecture, please ask to borrow a classmate's lecture notes.

Practice Problems

Practice problems, including Excel spreadsheet simulations, will be posted on the course website. The main purpose of these problems is to increase your understanding of course material by providing you with an opportunity to work through problems based on concepts and models learned in class. A major incentive to work through these practice problems carefully is that exam questions are correlated with these problems.

Tentative Reading List

* required readings (unstarred readings strongly recommended)

STERN	Nicholas Stern. (2007) The Economics of Climate Change: The Stern Review . Cambridge University Press.
CBA	David Pearce, Giles Atkinson, Susana Mourato. (2006) Cost-Benefit Analysis and the Environment: Recent Developments . OECD.
IPCC	Intergovernmental Panel of Climate Change. (2007) Climate Change 2007: Fourth Assessment Report .
HH	Dieter Helm and Cameron Hepburn, eds. (2009) <i>The Economics and Politics of Climate Change</i> . Oxford University Press.

I. Introduction and background

A. Science of climate change

- * STERN Ch. 1, The Science of Climate Change.
- * IPCC Working Group 1, The Physical Science Basis, [Summary for Policymakers](#).

B. Impacts of climate change

- * STERN Ch. 3, How Climate Change will Affect People Around the World, Ch. 4, Implications of Climate Change for Development, Ch. 5, Cost of Climate Change in Developed Countries.
- * IPCC Working Group II, [Summary for Policymakers](#).

IPCC Working Group II, *Impacts, Adaptation and Vulnerability*. (Nice summary tables with chapter references in Chapter 19.3).

C. Overview of key economic issues

- * STERN Ch. 2, Economics, ethics and climate change and Ch. 2, Technical Annex, Ethical Frameworks and Intertemporal Equity

II. Climate change damages

A. Economic approach to valuing climate change damages

- * Russell, C. S. (2001) “[Damage and Benefit Estimation](#).” Ch. 6 in Applying Economics to the Environment.

- * Brookshire, D., A. Randall, and J. Stoll. (1980) “[Valuing Increments and Decrements in Natural Resource Service Flows](#).” American Journal of Agricultural Economics, 478–488.

CBA Ch.2 Foundations of Cost-benefit Analysis and Ch. 11 Willingness to Pay vs Willingness to Accept.

III. Aggregating climate change damages

a. *Across space*

- * Fankhauser, S., R. Tol and D. Pearce. (1997) “[The Aggregation of Climate Change Damages: A Welfare Theoretic Approach](#).” Environmental and Resource Economics, 10, 249–66.

CBA Ch.15 Equity and Cost-benefit Analysis.

b. *Across time*

- * Perman et. al. (2003) “[Cost-benefit analysis](#)” Ch. 11, Natural Resource and Environmental Economics, 3rd Edition.

- * Dasgupta, P., K. Mäler, and S. Barrett. (2000) “[Intergenerational Equity, Social Discount Rates and Global Warming](#).”

CBA Ch.13 Discounting.

c. *Across risk*

- * Kolstad, C. (2000) “[Risk and Uncertainty](#)” Ch. 12 in Environmental Economics.

- * Hope, C. And D. Newbery. (2006) “[Calculating the social cost of carbon](#).” University of Cambridge mimeo.

Perman et. al. (2003) “[Irreversibility, risk and uncertainty](#).” Ch. 13 in Natural Resource and Environmental Economics, 3rd Edition.

IV. The Stern Review

A. Estimating climate change damages

- * STERN Ch. 6, “Economic Modelling of Climate-Change Impacts.”
- * Hope, C. (2006) “[The Marginal Impact of CO₂ from Page2002: An Integrated Assessment Model Incorporating the IPCC’s Five Reasons for Concern](#).” The Integrated Assessment Journal, 6, 1, 19–56.
- * Dietz, S. et. al. (2007) “[Some economics of ‘dangerous’ climate change: Reflections on the Stern Review](#).” Global Environmental Change, 17, 311-325.

B. The Stern Review debate (See course website.)

V. Economics of stabilisation

A. Stock pollution control model

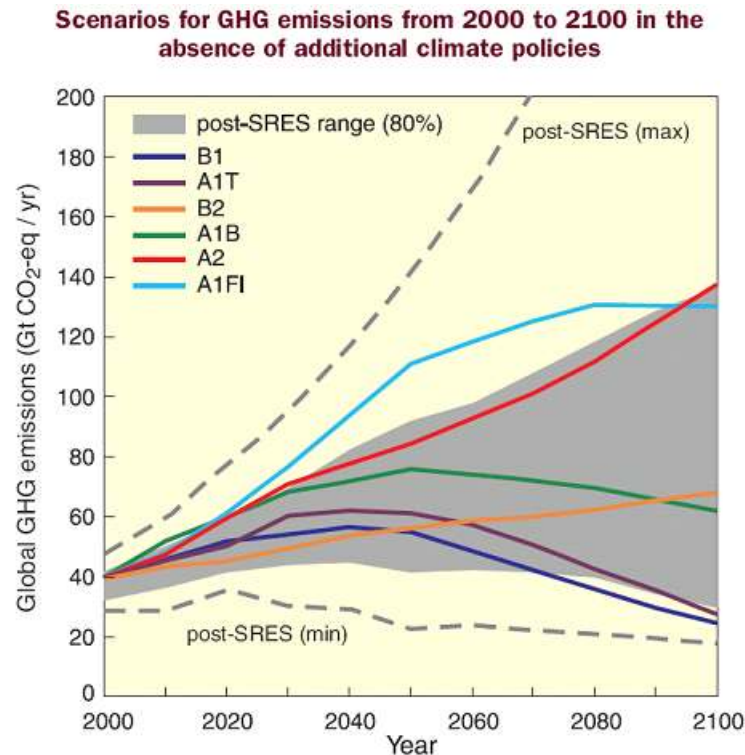
- * Johnson, D. (1995) “[The Economics of Stock Pollutants: A Graphical Exposition](#).” Journal of Economic Education, 236–44.
- * STERN, Ch. 9, Identifying the Costs of Mitigation, Ch. 13, Towards a goal for climate change policy.

VI. Policy responses for mitigation and adaptation

- * HH Ch. 3 Hepburn, C. and N. Stern. “The Global Deal on Climate Change.”
- * STERN Ch. 14, Harnessing markets for Mitigation - The Role of Taxation and Trading, Ch. 18, Understanding the Economics of Adaptation.
- * Hepburn, C. (2006) “[Regulation by Prices, Quantities, or both: A Review of Instrument Choice](#).” Oxford Review of Economic Policy, 22, 2, 226–247.
- * HH Ch 2 Helm, Dieter. “Climate-change Policy: Why has so Little been Achieved?”
- HH Ch. 18 Hepburn, C. “Carbon Taxes, Emissions Trading, and Hybrid Schemes.”
- IPCC Working Group III Mitigation of Climate Change, Ch. 13, “[Policies, instruments, and co-operative arrangements](#).”

VII. International collective action (*If time permits. Readings TBA*)

Special Report Emissions Scenarios SRES



A1 convergent world with “global” solutions

- very rapid economic growth, global population peaks mid-century then declines, rapid introduction of new and more efficient technologies
- Technological emphasis: fossil-intensive (A1F1), non-fossil energy sources (A1T), balanced energy sources (A1B)

A2 heterogeneous world with “local” solutions

- Global population increasing, per capita economic growth and technological change more fragmented and slower than other storylines

B1 convergent world with “global” solutions

- Key difference from A1 is move toward a service and information economy

B2 heterogeneous world with “local” solutions

- Global population increases at lower rate than A2, less rapid and more diverse technological change than in A1 and B1 storylines