

The Economics of Sustainability
0511-810
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Course Requirements:

Four problem sets @ 12.5% each:	50%
Phase 1 term paper	20%
Phase 2 term paper	20%
Class participation	5%
Paper presentation during finals	5%

Term Paper

The term paper will be constructed in two phases. Phase 1 is the preparation of a five-page double-spaced document that is due in class on **Thursday, January 19** (end of the fifth week of class). Phase 2 is the preparation of a ten to fifteen page (double-spaced) final paper that is due in class on **Tuesday, February 21**.

The Phase 1 document must include the following: (a) discussion of the topic and specific research question under study, (b) at least two economics peer-reviewed journal article references on the topic, (c) at least two non-economics peer-reviewed journal article references on the topic, (d) a constrained optimization model, and (e) discussion of the

approach one plans to take in developing this Phase 1 document into the Phase 2 final document.

The essential steps involved are the following:

1. Identify a provisional sustainability dissertation topic
 - i. Emphasis on *provisional*; here we are practicing how to execute economics research methodology as it applies to any sustainability topic. Therefore, the lessons learned can be transferred to any eventual sustainability dissertation topic.
 - ii. A sample topic is “Incentivizing Sustainable Waste Management” and a specific focus could be on the strategic production input selection of waste disposal facility operators. How can facility location, on-site waste quality monitoring, and leachate control engineering decisions be managed to achieve greater waste disposal facility sustainability?
2. Identify economic tensions in one’s topic
 - i. Where there is scarcity, there is an economic tension.
3. Locating economics and non-economics peer-reviewed research on the topic/tension.
 - i. One can search by journal title at <http://library.rit.edu> or one can search key words within a database of journals, such as the ScienceDirect database at <http://wally.rit.edu/electronic/scidirect/scidirect.html> or the EconLit database at <http://wally.rit.edu/electronic/econlit/econlit.html> and/or see the list of economics journals at <http://www.oswego.edu/~economic/journals.htm>.
4. Sections of standard economics research papers
 - i. Introduction
 - ii. The Theoretical Model
 - iii. The Data (if appropriate)
 - iv. Results and Interpretations
 - v. Conclusions and Directions for Future Research.

The outline of materials for our studies is as follows:

Lecture 1

The Problem of Sustainability and the Economics Paradigm

Professor Wagner

A. Readings

- a. Norton, B.; Toman, M. A. (1997). Sustainability: ecological and economic perspectives. *Land Economics* 73(4): 553-569.
- b. Heal, G. (1998). Valuing the Future: Economic Theory and Sustainability, Columbia University Press, Chapter 1.
- c. Perrings, C. (2006). Resilience and sustainable development. *Environment and Development Economics* 11(4): 417-427.
- d. Howarth, R. B. (2007). Towards an operational sustainability criterion. *Ecological Economics* 63(4): 656-663.

B. Today's topics

- a. Introductions
- b. Discuss course syllabus/logistics—intermediate microeconomics prerequisite, nature of class meetings, problem sets, term paper development and assignment/course grades.
- c. Overview of course material and teaching approach. First five weeks regard “The Microeconomics of Green Consumption/Design and Sustainability” and will be taught by Prof. Wagner. The second five weeks regard “Dynamic Economic Growth Models and Sustainability” and will be taught by Prof. Batabyal.
- d. Today's topic: The problem of sustainability and the economics paradigm. Please consider the above readings as soon as possible.
- e. Four key economic tensions regarding sustainability: the **substitutability** between natural and engineered capital; the **reversibility** of our choices in each time period; the **resiliency** of the ecological-economic system; and the **asymmetry** between the wishes of present generation versus the wishes of future generations who are not present to vote (with ballots or money) as to how things should be.
- f. Two time perspectives: static and dynamic models. Static models enable us to study economic tensions that arise when time is not a factor, thereby helping us understand what changes, and what does not change, when we add time as a factor.
- g. Two economic scopes for study: microeconomic and macroeconomic. We shall begin our studies with static microeconomic considerations (under the rubric “green consumption and green design”) and work toward dynamic macroeconomic considerations (under the rubric “economic growth with sustainability”).

Lecture 2
Essential Microeconomic Theory
Professor Wagner

A. Reading

Microeconomic theory text chapters regarding consumer theory. For instance, Nicholson, W.; Snyder, C. (2008). Microeconomic Theory: Basic Principles and Extensions, 10th ed., Thomson Southwestern, ISBN 978-0-324-58507-0 (book only), chapters 3-6, which we will draw upon for Lectures 2-5. However, one may utilize an alternative text.

B. Today's topics

- a. Optimal consumer choice.
- b. Uncompensated (Marshallian) demand functions.
- c. Indirect utility functions and expenditure functions.
- d. Compensated (Hicksian) demand functions.
- e. Slutsky equation.

Lecture 3
Welfare Measures in Green/Sustainability Contexts
Professor Wagner

A. Readings

- a. Norton, B.; Costanza, R.; Bishop, R. (1998). The evolution of preferences: why 'sovereign' preferences may not lead to sustainable policies and what to do about it. *Ecological Economics* 24(2-3): 193-211.
- b. Wagner, J. (2006). On the economics of sustainability. *Ecological Economics* 57(4): 659-664.
- c. Brekke, K. A. (1997). The numeraire matters in cost-benefit analysis. *Journal of Public Economics* 64(1): 117-123.

B. Today's topics

- a. Alternative perspectives on preferences, optimal choice and sustainability.
- b. Compensating variation, equivalent variation and consumer surplus.
- c. A compensating variation application (Wagner 2006).
- d. An equivalent variation application (Brekke 1997).

Lecture 4
Environmentally Friendly Consumption
Professor Wagner

A. Readings

- a. Kotchen, M. J. (2005). Impure public goods and the comparative statics of environmentally friendly consumption. *Journal of Environmental Economics and Management* 49(2): 281-300.

- b. Mills, B.; Schleich, J. (2010). Why don't households see the light? Explaining the diffusion of compact fluorescent lamps. *Resource and Energy Economics* 32(3): 363-378.

B. Today's topics

- a. Green products as impure public goods.
- b. Comparative statics: generating testable hypotheses.
- c. Economic aspects of green technology adoption by households.

C. Distribute Problem Set #1, due at next class

Lecture 5

Moral Motivation and Green Consumption

Professor Wagner

A. Readings

- a. Brekke, K.; Kverndokk, S.; Nyborg, K. (2003). An economic model of moral motivation. *Journal of Public Economics* 87(9-10): 1967-1983.
- b. Nyborg, K.; Howarth, R. B.; Brekke, K. A. (2006). Green consumers and public policy: on socially contingent moral motivation. *Resource and Energy Economics* 28(4): 351-366.

B. Today's topics

- a. Modeling "effort".
- b. Modeling moral motivation.
- c. Coordination failures.

C. Collect Problem Set #1 in class

Lecture 6

Green Design and Remanufacturing

Professor Wagner

A. Readings

- a. Calcott, P.; Walls, M. (2005). Waste, recycling and 'design for environment': roles for markets and policy instruments. *Resource and Energy Economics* 27(4): 287-305. (See also the production chapters in a microeconomic theory text, such as Nicholson & Snyder (2008) chapters 9-11.)
- b. Bernard, S. (2011). Remanufacturing. *Journal of Environmental Economics and Management* 62(3): 337-351.

B. Today's topics

- a. Accounting for "upstream" and "downstream", lifecycle externalities.
- b. Economic concepts of green design.
- c. Green design with multiple recycling options.

- d. Endogenous choice of recyclability/remanufacturability.

Lecture 7

Modeling Strategic Firm Behavior in Sustainability Contexts

Professor Wagner

A. Readings

- a. Bui, L. T. M. (1998). Gains from trade and strategic interaction: equilibrium acid rain abatement in the Eastern US and Canada. *American Economic Review* 88(4): 984-1001.
- b. Borenstein, S.; Bushnell, J.; Stoft, S. (2000). The competitive effects of transmission capacity in a deregulated electricity industry. *RAND Journal of Economics* 31(2): 294-325.

B. Today's topics

- a. Cournot-Nash equilibrium frameworks (NS pp. 252-254, 524-530).
- b. Two applications of Cournot-Nash strategic gaming in sustainability contexts.

Lecture 8

Economics of Eco-Labels and Eco-Certification

Professor Wagner

A. Readings

- a. Teisl, M. F.; Roe, B.; Hicks, R. L. (2002). Can eco-labels tune a market? Evidence from dolphin-safe labeling. *Journal of Environmental Economics and Management* 43(3): 339-359.
- b. Hamilton, S. F.; Zilberman, D. (2006). Green markets, eco-certification, and equilibrium fraud. *Journal of Environmental Economics and Management* 52(3): 627-644.

B. Today's topics

- a. Conceptualizing the economic impact of eco-labels and eco-certification.
- b. Measuring the effectiveness of eco-labels and eco-certification.
- c. Some comparative statics of eco-certification.

C. Distribute Problem Set #2, due at next class.

Lecture 9

Comparing Economic Instruments: Applications to Greenhouse Gas Reductions

Professor Wagner

A. Readings

- a. Holland, S. P.; Hughes, J. E.; Knittel, C. R. (2009). Greenhouse gas reductions under low carbon fuel standards? *American Economic Journal: Economic Policy* 1(1): 106-146.

- b. Fischer, C.; Parry, I. W. H.; Pizer, W. (2003). Instrument choice for environmental protection when technological innovation is endogenous. *Journal of Environmental Economics and Management* 45(3): 523-545.
- c. Johnstone, N.; Haščič, I.; Popp, D. (2010). Renewable energy policies and technological innovation: Evidence based on patent counts. *Environmental and Resource Economics* 45(1): 133-155.

B. Today's topics

- a. Market modeling with regulatory standards, fees and/or marketable permit instruments.
- b. Comparing economic impact of alternative instruments.
- c. Considering incentives to innovate in presence of alternative policy instruments.

C. Collect Problem Set #2 in class today.

Lecture 10

Managing Uncertainty, Potential Liability and Nonlinear Budget Constraints

Professor Wagner

A. Readings

- a. Dyar, J. A.; Wagner, J. (2003). Uncertainty and species recovery program design. *Journal of Environmental Economics and Management* 45(2S): 505-522.
- b. Bhole, B.; Wagner, J. (2008). The joint use of regulation and strict liability with multidimensional care and uncertain conviction. *International Review of Law and Economics* 28(2): 123-132.

B. Today's topics

- a. Likelihood of program success as economic objective.
- b. Potential harm and nonlinear budget constraints.
- c. Managing legal uncertainty.
- d. Take away points from Dyar and Wagner (2003).
- e. Combining regulation and strict liability in products liability and environmental/sustainability contexts (Bhole and Wagner, 2008).

C. Collect Phase #1 Term Paper in class today.

Lectures 11 and 12
The Basic Solow Growth Model
Professor Batabyal

Lecture 11 Topic: Stylized Facts about Economic Growth and Introduction to the Solow Growth Model.

- Readings:
- Jones, C.I. 2002. *Introduction to Economic Growth*, 2nd edition. Norton, New York, New York, Chapters 1 and 2.
 - Solow, R.M. 1956. A contribution to the theory of economic growth, *Quarterly Journal of Economics*, 70, 65-94.
 - Solow, R.M. 1970. *Growth Theory*. Oxford University Press, Oxford, UK, Chapter 1.

Lecture 12 Topic: Solow Growth Model in Detail; Technology, Analytical Solutions, Introductory Growth Accounting.

- Readings:
- Jones, C.I. 2002. *Introduction to Economic Growth*, 2nd edition. Norton, New York, New York, Chapter 2.
 - Solow, R.M. 1957. Technical change and the aggregate production function, *Review of Economics and Statistics*, 39, 312-320.
 - Miller, M.H., and Upton, C.W. 1986. *Macroeconomics*. University of Chicago Press, Chicago, Illinois, Chapter 2.

Lectures 13 and 14
The Solow Growth Model With Natural Resources
Professor Batabyal

Lecture 13 Topic: Exhaustible and Renewable Resources in the Solow Model.

- Readings:
- Jones, C.I. 2002. *Introduction to Economic Growth*, 2nd edition. Norton, New York, New York, Chapter 9.
 - Nordhaus, W.D. 1992. Lethal model 2: The limits to growth revisited, *Brookings Papers on Economic Activity*, 2, 1-59.
 - Solow, R.M. 2000. Sustainability: An economist's perspective, in R.N. Stavins, (Ed.), *Economics of the Environment*, 4th edition. Norton, New York, New York.

Lecture 14 Topic: Quantifying Importance of Natural Resources and Prices as Indicators of Scarcity.

- Readings:
- Jones, C.I. 2002. *Introduction to Economic Growth*, 2nd edition. Norton, New York, New York, Chapter 9.
 - Hartwick, J.M. 1977. Intergenerational equity and the investing of rents from exhaustible resources, *American Economic Review*, 67, 972-974.

- Sorensen, P.B., and Whitta-Jacobsen, H.J. 2004. *Introducing Advanced Macroeconomics*. McGraw Hill, Maidenhead, Berkshire, UK, Chapter 7.

Lectures 15 and 16

Natural Resource Use and Sustainability in a Classical Framework

Professor Batabyal

Lecture 15 Topic: Exhaustible Resources.

- Readings:
- Heal, G.M. 1998. *Valuing the Future*. Columbia University Press, New York, New York, Chapter 3.
 - Krautkraemer, J.A. 1985. Optimal growth, resource amenities, and the preservation of natural environments, *Review of Economic Studies*, 52, 153-170.
 - Conrad, J.M., and Clark, C.W. 1987. *Natural Resource Economics*. Cambridge University Press, Cambridge, UK, Chapters 1 and 3.

Lecture 16 Topic: Renewable Resources.

- Readings:
- Heal, G.M. 1998. *Valuing the Future*. Columbia University Press, New York, New York, Chapter 4.
 - Roughgarden, J., and Smith, F. 1996. Why fisheries collapse and what to do about it, *Proceedings of the National Academy of Sciences*, 93, 5078-5083.
 - Conrad, J.M., and Clark, C.W. 1987. *Natural Resource Economics*. Cambridge University Press, Cambridge, UK, Chapter 2.

Lectures 17 and 18

Ecological Economics

Professor Batabyal

Lecture 17 Topic: Ecosystems, Biodiversity, Stability, and Resilience.

- Readings:
- Holling, C.S., Schindler, D.W., Walker, B.W., and Roughgarden, J. 1995. Biodiversity in the functioning of ecosystems: An ecological synthesis, in C. Perrings, K. Maler, C. Folke, C.S. Holling, and B. Jansson, (Eds.), *Biodiversity Loss*. Cambridge University Press, Cambridge, UK.
 - Perrings, C. 1995. Biodiversity conservation as insurance, in T.M. Swanson, (Ed.), *The Economics and Ecology of Biodiversity Decline*. Cambridge University Press, Cambridge, UK.
 - Holling, C.S. 1996. Engineering resilience versus ecological resilience, in P.C. Schulze, (Ed.), *Engineering Within Ecological Constraints*. National Academy Press, Washington, DC.

Lecture 18 Topic: Ecosystem Services.

- Readings:
- Costanza, R., Cumberland, J., Daly, H., Goodland, and Norgaard, R. 1997. *An Introduction to Ecological Economics*. St. Lucie Press, Boca Raton, Florida, Chapter 3.
 - Batabyal, A.A., Kahn, J.R., and O'Neill, R.V. 2003. On the scarcity value of ecosystem services, *Journal of Environmental Economics and Management*, 46, 334-352.
 - Daily, G.C., Soderqvist, T., Aniyar, S., Arrow, K.J., Dasgupta, P.S., Ehrlich, P.R., Folke, C., Jansson, A., Jansson, B., Kautsky, N., Levin, S., Lubchenco, J., Maler, K., Simpson, D., Starrett, D., Tilman, D., and Walker, B. 2000. The value of nature and the nature of value, *Science*, 289, 395-396.

Lectures 19 and 20
Ecological Economics and Climate Change
Professor Batabyal

Lecture 19 Topic: Swidden Agriculture.

- Readings:
- Dufour, D.L. 1990. Use of Tropical Rainforests by Native Amazonians, *BioScience*, 40, 652-659.
 - Southgate, D. 1990. The causes of land degradation along spontaneously expanding agricultural frontiers in the third world, *Land Economics*, 66, 93-101.
 - Batabyal, A.A., and Beladi, H. 2004. Swidden agriculture in developing countries, *Review of Development Economics*, 8, 255-265.

Lecture 20 Topic: Global Warming.

- Readings:
- Kahn, J.R. 1998. *The Economic Approach to Environmental and Natural Resources*, 2nd edition. Dryden Press, Fort Worth, Texas, Chapter 6.
 - Nordhaus, W.D. 2007. To tax or not to tax: Alternative approaches to slowing global warming, *Review of Environmental Economics and Policy*, 1, 26-44.
 - Dasgupta, P.S. 2007. Commentary: The Stern Review's economics of climate change, *National Institute Economic Review*, 199, 4-7.