NRE 570
Environmental Economics:
Principles, Methods, and Tools
Fall 2017

Time: Tuesday and Thursday, 11:30am-1:00pm
Room: 1028 Dana

Michael Moore
Dana 3516
micmoore@umich.edu; 734-647-4337 (office)
Office hours: Monday 1-2:00pm, Wednesday 12-1:00pm, and by appointment

Brent Heard
Dana 1540
brheard@umich.edu
Office hours: Tuesday 10-11:00am, Thursday 10-11:00am, and by appointment
(Note: Brent will be leading Excel sessions in Dana 3556 at 10am on several Thursdays.)

If you are contacting the instructors via email, please write in the Subject line: NRE570 topic of message. We will reply within 24 hours during the week.

Overview: This course develops the conceptual frameworks of microeconomics and environmental economics that are essential for an environmental professional. It also introduces the quantitative methods for applying the frameworks along with a Microsoft Excel toolkit for the applications. Topics covered include markets and market failures; nonmarket valuation of environmental goods and services; benefit-cost analysis; environmental regulation; and natural resource allocation.

Learning Goals: To develop an ability to use economic principles for diagnosing environmental issues and prescribing policy interventions; to develop a general understanding of the main quantitative methods of economics; and to develop expertise in Excel as a quantitative toolkit.

Learning Mechanisms: (i) homework assignments, (ii) a mid-term exam and a final exam, (iii) lectures and in-class exercises, (iv) reading and listening assignments, (v) optional Excel skills sessions. Readings and assignments will be distributed through the Canvas website.

Prerequisites: None.

Evaluation: The final grade will be based on: 7-8 homework assignments (50%), the mid-term exam (25%), and the final exam (25%). The final exam is not cumulative.

Note 1: If any student feels that he/she may need an accommodation for any type of disability, please make an appointment to talk with the instructor or stop by during office hours.

Note 2: Students are expected to take personal responsibility for understand and observing the Rackham Academic and Professional Integrity Policy, see: http://www.rackham.umich.edu/current-students/policies/academic-policies/section11
Optional Excel skills sessions: Brent will lead optional sessions on selected Thursdays, 10:10-11:00am, Room 3556 Dana.

Take-home Mid-term Exam: due Friday, October 27.
Take-home Final Exam (noncumulative): due Tuesday, December 19.

Merging Principles, Methods, and Tools: most courses in economics separate content based on principles and conceptual frameworks versus quantitative methods and their application tools. This course is designed differently with two precepts in mind. First, environmental professionals require a defined set of microeconomic principles to function effectively in the field, such that comprehensive instruction in microeconomics is unnecessary for most individuals. Second, the best time to learn quantitative methods and tools is in the context of the underlying economic principles, rather than in stand-alone courses on mathematical economics and econometrics.

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Condensed Outline

Positive and Normative Analysis of Markets
- The consumer problem. Demand functions.
- The problem of the firm. Supply functions.
- Market equilibrium (competition)
- Normative analysis: Economic efficiency using consumer’s surplus & producer’s surplus

Market Failures and the Theory of Environmental Policy
- Externalities, public goods, and common pool resources
- Game theory and strategic behavior
- Policy instruments of environmental regulation

Intertemporal Decision-Making
- Time discounting

Public Decision-Making Frameworks
- Benefit-cost analysis
- Cost-effectiveness analysis
- Economic impact analysis

Natural Resource Allocation with a Fixed Quantity
- Cap-and-trade pollution
- River water
- Nonrenewable energy
- Atmospheric concentration of greenhouse gases

National Income Accounting and Macroeconomics
- Environmental (green) accounting
- Environmental Kuznets curves: environmental pollution versus economic growth
## Course Details

<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Topic</th>
<th>Method/Tool</th>
<th>Reading</th>
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<tbody>
<tr>
<td>1</td>
<td>Sept. 5, 7</td>
<td>• National income accounting (part 1)</td>
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<td>1, 2, 3</td>
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<td></td>
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<td>• Consumer demand</td>
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<td>2</td>
<td>Sept. 12, 14</td>
<td>• Application to the <em>rebound effect</em></td>
<td>Algebraic operations</td>
<td>4, 5</td>
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<td>• <em>Smarting over Smart Meters</em> case</td>
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<td>3</td>
<td>Sept. 19, 20</td>
<td>• Regression: statistical estimation of consumer demand functions</td>
<td>Regression statistical model</td>
<td>6, 7</td>
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<td>4</td>
<td>Sept. 26, 28</td>
<td>• Program evaluation: randomized controlled trials &amp; natural experiments</td>
<td>Regression statistical model</td>
<td>8, 9, 10</td>
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<td>• Application to <em>Opower’s</em> electricity demand management program</td>
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<td>5</td>
<td>Oct. 3, 5</td>
<td>• Economic valuation of nonmarket environmental goods and services</td>
<td>Regression statistical model</td>
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<td>• Recreation and water quality applications</td>
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<td>6</td>
<td>Oct. 10, 12</td>
<td>• Producer supply</td>
<td>Regression statistical model</td>
<td>12, 13,</td>
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<td></td>
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<td>• Competitive market equilibrium</td>
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<td>14</td>
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<tr>
<td>7</td>
<td>Oct. 19</td>
<td>• Competitive market equilibrium</td>
<td>Economic efficiency</td>
<td>15, 16</td>
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<td></td>
<td>(Fall Break on Oct. 16-17)</td>
<td>• Externality and market failure</td>
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<td>• Environmental regulation</td>
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<td>• <em>Mid-term Exam due Friday, Oct. 27</em></td>
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<td>8</td>
<td>Oct. 24, 26</td>
<td>• Discounting</td>
<td>Excel’s tools for financial analysis</td>
<td>20, 21,</td>
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<td>• Benefit-cost analysis</td>
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<td>22, 23</td>
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<td>• Cost-effectiveness analysis</td>
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<td>• Economic impact analysis</td>
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<td>9</td>
<td>Oct. 31, Nov. 2</td>
<td>• Allocation problems: the common structure of applying the equimarginal principle to allocate a fixed supply (of anything) among entities or over time</td>
<td>Excel’s Goal Seek and Solver</td>
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<td>10</td>
<td>Nov. 7, 9</td>
<td>• Public goods &amp; common pool resources</td>
<td>Game theory</td>
<td>24, 25,</td>
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<td>• Game theory</td>
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<td>11</td>
<td>Nov. 14, 16</td>
<td>• Allocation problems: the common structure of applying the equimarginal principle to allocate a fixed supply (of anything) among entities or over time</td>
<td>Excel’s Goal Seek and Solver</td>
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<td>12</td>
<td>Nov. 21</td>
<td>• Allocation problems: a government budget; water; cap-and-trade pollution</td>
<td>Goal Seek and Solver</td>
<td>28, 29,</td>
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<td>(Thanksgiving on Nov. 23)</td>
<td>• Applications to Colorado River and to sulfur dioxide cap-and-trade program</td>
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<td>13</td>
<td>Nov. 28, 30</td>
<td>• Allocation problems: energy and climate as intertemporal problems</td>
<td>Goal Seek and Solver</td>
<td>31, 32</td>
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<td>• Applications to energy and climate</td>
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<tr>
<td>14</td>
<td>Dec. 5, 7</td>
<td>• National income accounting (part 2)</td>
<td>Goal Seek and Solver</td>
<td>33, 34</td>
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<td>• Environmental (green) accounting</td>
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<td>15</td>
<td>Dec. 12 (last day of class)</td>
<td>• Environmental Kuznets curves: pollution versus economic growth</td>
<td>Regression statistical model</td>
<td>35, 36</td>
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<tr>
<td>16</td>
<td>Dec. 20</td>
<td>• <em>Final Exam due Tuesday, Dec. 19</em></td>
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Readings


1. Mankiw textbook, Chapter 4, The Market Forces of Demand and Supply. Read materials on “Demand” from this chapter.

2. Mankiw textbook, Chapter 5, Elasticity and Its Application. Read materials related to “The Elasticity of Demand” from this chapter.

3. Mankiw textbook, Chapter 7, Consumers, Producers, and the Efficiency of Markets. Read material on “Consumer Surplus” from this chapter.


5. Petito and others, “Smarting over Smart Meters: Does Smart Grid Technology have a Home in Maryland.” Teaching case.


12. Mankiw textbook, Chapter 4, The Market Forces of Demand and Supply. Read materials on “Supply” from this chapter.


14. Mankiw textbook, Chapter 7, Consumers, Producers, and the Efficiency of Markets. Read material on “Producer Surplus” from this chapter.

15. Mankiw textbook, Chapter 4, The Market Forces of Demand and Supply. Read materials on “Supply and Demand Together” from this chapter.

16. Mankiw textbook, Chapter 7, Consumers, Producers, and the Efficiency of Markets. Read material on “Market Efficiency” from this chapter.

17. Mankiw textbook, Chapter 10, Externalities.


25. Mankiw textbook, Chapter 16, Game Theory and the Economics of Cooperation (a portion of Chapter 16).


27. Variations on textbook developments of the equimarginal principle solution to allocating a fixed supply (handout).


33. Mankiw textbook, Chapter 23, “Measuring a Nation’s Income.”

