API-302
ANALYTIC FRAMEWORKS FOR POLICY
Course Information

Where, When:	Lecture: Kennedy School of Government, Land
	Tuesday/Thursday, 10:15-11:30 a.m.
	Review Sections: L-230, Friday, 2:45-4:00 p.m.
Instructor:	Richard Zeckhauser, L-312, 495-1174
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Secondary Instructor:	Christopher Avery, L-212, 496-4063
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Teaching Fellows/CAs:	Kate Lofgren, Ignacio Quintana, Lina Song, Nagarajan Srinivasan
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Office Hours:	Thursday, 2:00-4:00 p.m., L-312

Course Description

Develops abilities in using analytic frameworks in the formulation and assessment of public policy. Considers a variety of analytic techniques, particularly those directed toward uncertainty and interactive decision problems. Emphasizes the application of techniques to policy analysis, not formal derivations. Students encounter case studies, methodological readings, the computer, the Internet, a final exam, and challenging problem sets. A reading period assignment is highly optional.

Content:
- Economics
- Analytic Methods
- Finance
- Game Theory
- Behavioral Economics
- Policy Assessment and Prescription

Prerequisites

- Significant interest in policy issues.
- Positive attitude toward using analytic approach to policy issues.
- Elementary decision theory (e.g., Howard Raiffa, *Decision Analysis*).
- Comfort with or ability to master mathematical concepts (elementary probability, matrices, calculus—see Math Review section below.)
- Acquaintance with analytic models (e.g., Edith Stokey and Richard Zeckhauser, *A Primer for Policy Analysis*).
- Intermediate level understanding of microeconomics (e.g., Pindyck and Rubinfeld, *Microeconomics*, or Mankiw, *Principles of Microeconomics*.
- Intrigued by game theory.
- Open minded to new disciplinary approaches.
- Moderate Internet appetite.

- Diligence.
- Inquiring mind.
- Sense of humor.

Course Requirements

- Regular use of name card.
- Reading assignments to be completed for each class.
- Problem of the day when given.
- Discussion problem of the day when given. Students will sometimes be asked to submit responses electronically in advance of class.
- Acceptance of cold calls in class.
- Participation in study groups.
- Three problem sets.
- Participation in class discussion.
- Work on the personal computer (includes working with spreadsheets and the Internet).
- Preparation of class notes for classmates.
- Enrichment exercise.
- Possible written assignments.
- Reading period assignment optional. Nature of assignment not yet determined.

Prerequisites and Course Requirements will be discussed on the first day of class.

Portfolio of Materials and Rationale

Some types of material are best mastered by reading, some through lecture, some through independent assignments, and others through working problems. This course seeks to allocate subject areas and methods to the mechanisms that teach them best. (If you understand this approach, you already understand a fundamental principle of optimization.) The consequence is that there is often less overlap among readings, lectures, and problems in this class than you might expect from past experience. Just because a topic is not discussed in class does not mean that it is not important. In general, particular analytic techniques are taught through readings. Their application, justification, and weaknesses are more likely to be the subject of in-class instruction and discussion. Structure your expectations and study habits for this course accordingly. If you do not like this "nonlinear" format, this course is not for you.

Final Exam: 3-hour in-class exam, Thursday, 12/7/17, 3:00-6:00 p.m.
Location to be announced by Registrar. (Some potential questions may be handed out in advance.)

Participation in study groups is required. We will arrange groups.

Seating: Select the seat you want for the semester on Thursday, September 14. A seating chart will be prepared and you will be expected to sit in the same seat each class. Please use your name card each class <u>all</u> semester, even if you are confident that the instructor knows your name.

Sections: Weekly sections will be taught by our able teaching fellows. The sections are important to attend, since they cover core concepts mentioned but not developed in lectures. They will review some topics covered in class or in readings, and will provide guidance in approaching problem sets (indeed provide hints). Some review sessions will cover supplementary material, which may focus on methodological topics, e.g., new developments in behavioral economics, or areas of application, e.g., economic development or corruption. Despite our best efforts, arranging a section time that is

accessible to each and every student is not possible. We will video record our review sessions to lessen any difficulties on this score.

Problem of the Day: For a small number of classes a problem will be distributed. It will be the focus for a significant amount of discussion for the next class. Students will be expected to analyze the problem of the day and be prepared to discuss their thinking and/or results. For some problems, collaboration will be permitted. The Problem of the Day is not to be turned in.

Discussion Problem of the Day: For some classes, a discussion question will be distributed. Students will usually be expected to submit a response prior to class, electronically. These responses will be brief – words only, no math. The Discussion Problem of the Day response is to be submitted online on the Canvas course site by 2:00 p.m. the day before the class in which it will be discussed. Credit is given.

Text and Readings

Materials in this course will be available online on the Canvas course site. A continuing string of short supplementary readings will be distributed in class. Most short materials prepared by API-302 participants, including class notes, will be distributed online on the Canvas course site.

The following are useful references, which are on reserve in the HKS library. If you wish to buy a text (or even just borrow it from the library), there are multiple examples on both game theory and economics. Look at more than one before you leap.

Alpha C. Chiang, *Fundamental Methods of Mathematical Economics*
      (often used as a text for "Mathematics for Economists" course in Economics Department)

Thomas E. Copeland and J. Fred Weston, *Financial Theory and Corporate Policy*
      (a helpful, comprehensible finance text)

Morris H. DeGroot, *Probability and Statistics*
      (a thorough, mathematically oriented approach to probability and statistics)

Avinash Dixit and Susan Skeath, *Games of Strategy*
      (a highly accessible text on game theory)

Robert Gibbons, *Game Theory for Applied Economists*
      (a somewhat challenging but basically accessible game theory text with an emphasis
      on application)

Frederick S. Hillier and Gerald J. Lieberman, *Introduction to Operations Research*
      (a good, reasonably easy supplementary text on analytic techniques)

*Daniel Kahneman, *Thinking, Fast and Slow*
      (a relatively recent broad-ranging book on behavioral decision)

Daniel Kahneman, Paul Slovic, and Amos Tversky, *Judgment Under Uncertainty: Heuristics
      and Biases*
      (a collection of excellent pioneering articles on behavioral decision)

David M. Kreps, *A Course in Microeconomic Theory*
      (an elegantly presented text, with an emphasis on game theory. You might purchase this
      volume if you have a strong interest in economics.)

R. Duncan Luce and Howard Raiffa, *Games and Decisions*
      (a classic, reasonably accessible presentation of game theory)

Greg Mankiw, *Principles of Microeconomics*
        (a clear and accessible and highly regarded introduction to microeconomics)

Roger B. Myerson, *Game Theory*
        (a contemporary but advanced text)

Walter Nicholson, *Microeconomic Theory*
        (a good microeconomics text that is a touch more advanced than Mankiw. It covers required
        background material on microeconomics.)

Robert S. Pindyck and Daniel L. Rubinfeld, *Microeconomics*
        (an excellent introductory text)

*Howard Raiffa, *Decision Analysis*
        (the most accessible way to learn this important material)

Howard Raiffa, John Richardson, and David Metcalfe, *Negotiation Analysis: The Science and
        Art of Collaborative Decision Making*
        (the most recent masterful treatise by Raiffa)

*Thomas Schelling, *Micromotives and Macrobehavior*
        (though not a textbook, this book teaches by example. It is an elegant presentation of
        interactive models applied to policy)

 *Edith Stokey and Richard Zeckhauser, *A Primer for Policy Analysis*
        (covers required background material in analytic methods at an introductory level, available
        at the COOP)

Richard Thaler, *The Winner's Curse*
        (highly readable and full of fun-filled facts, available at the COOP)

Jean Tirole, *The Theory of Industrial Organization*
        (an excellent and challenging book on the current state of industrial organization, with an
        emphasis on game theory.)

Hal R. Varian, *Microeconomic Analysis*
        (a useful, more advanced text)

Harvey M. Wagner, *Principles of Operations Research*
        (a supplementary text, more difficult than Hillier and Lieberman)

*Richard Zeckhauser, ed., "Problems in Analytic Methods"
        (workbook of problems typical of API-302 exam or problem set questions. On reserve in
        the library.)

Course materials will be numbered in sequence as either **A** (administrative), **S** (short pieces, often
newspaper articles), **R** (readings), **PS** (problem sets and solutions), **D** (discussion problems),
P (problems of the day), or **E** (enrichment exercises). Extra copies of handouts distributed in class
can be found on the shelf outside of Professor Zeckhauser's office (L-312), and frequently online on
the Canvas course site.

Problem Sets

Problem Set	Due Date
One	Thursday, October 5 (distributed 9/14)
Two	Thursday, November 2 (distributed 10/12)
Three	Thursday, November 30 (distributed 11/9)

Problem sets are due by 10:00 a.m. at the beginning of class. From time to time, additional

problems will be presented in class that can substitute for portions of a problem set. A short paper may be assigned that can substitute for some or all of Problem Set Three. Late problem sets are penalized 10 points immediately and then 10 additional points every additional 24 hours.

We organize students into study groups, primarily to work on problem sets. Even if you can do the problem set without the help of a group, you will get more out of the problem set by working with others; there is much to be learned from others' approaches to modeling and problem-solving.

Collaboration on problem sets must not include the preparation of final answers: all students must write up their answers independently. This means that problem set collaboration is limited to discussion only, perhaps with the help of a white board or scrap paper. No text, Excel formula, or equation should be copied verbatim in the process, and no student should share his or her write-ups with others. In fact, students should not even sit together and write up answers in close collaboration. While students may share a common approach and even final numeric solutions, all write-ups must be independent.

Students who consult a previous year's answer keys, copy another's work, or give their work to be copied will be deemed to have cheated and will be punished appropriately. Please, please, do not cheat. We prosecute. That said, be open and generous in your discussions; helping others is a good thing in API-302, as in life.

Math Review

In the first two or three weeks of class, we will have math review sessions each Friday. These sessions are mandatory for anyone who is not comfortable with the material that will be covered. Although this is not a course on mathematics or quantitative methods, you will better understand and formulate many of the intuitive ideas presented in the class with the help of some basic mathematical techniques. In addition, the material covered in these math reviews will be useful groundwork for the problem sets and the final exam. (It should also be useful for other courses, and for life.) Note, however, that our assumption is that you have little or a moderate amount of training in mathematics but are willing to learn as required. There will be an Excel simulation review (date/time and location to be announced).

Math Review 1, 2, and 3

Algebra and Math Tools:	logarithms and exponents, series and sums of infinite series, difference equations, etc. (read Part I of R-A, "Notes on Math Basics.")
Probability:	Sample spaces and events, conditional probabilities, Bayes rules, random variables, probability distribution and density functions (binomial, uniform, normal, etc.) (read R-B, "Notes on Probability.")
Calculus:	functions and derivatives, differential rules, optimization techniques, introductory integral calculus (read Part II of R-A, "Notes on Math Basics.")
Matrices:	Matrix addition, multiplication, inversion
Spreadsheets:	simulation, Markov processes, random variables, matrices

Discussion Board

API-302 will be employing a discussion board, available on our Canvas course site. Students will be encouraged to engage in online discussion as an adjunct to class participation.

Traditionally, course assistants get inundated with requests for help shortly before problem sets are due. Utilizing the discussion board, we will have a blackout period of 72 hours before a problem set. For that period, all student inquiries relating to the problem set will be taken only via the discussion board. This shares information widely, and also assures that any response that could include hints on how to proceed will be available to the whole class. We reserve the right to alter this format during the semester, as we learn about its strengths and weaknesses. We will also maintain a chat room after graduation for API-302 graduates.

Administrative questions, e.g., about whether an assignment was received, should be submitted to a TF at any time.

Previous Work

Designing this course is a challenge, given the varying backgrounds of our students. A number of MPP and two-year MPA students took analytics and economics courses last year. Enrollees from the Mid-Career Program are likely to have taken the advanced Analytics Section in the Summer Program. A few of you will be taking the Kotowski course, "Microeconomic Theory" (API-111) concurrently. These courses contain some of the material that has been taught in API-302 in the past.

But we are nothing if not flexible. We have tried to develop a curriculum that avoids overlap with prior efforts to the extent possible, yet covers relevant materials so individuals without this prior work will not suffer. As we shall discuss during the course, it is impossible to maximize simultaneously on two dimensions. But we can strive to strike an appropriate balance, and we shall so strive.

First, where some old material is only important, but not essential, we may replace it with some other important topic. Second, for the essential material, we shall ask those who have little background in analytic methods to do a modest amount of background reading in *A Primer for Policy Analysis*. Third, if one or two holes are discovered as we proceed, our course assistants will hold special review sessions.

Ph. D. Students

API-302 is designed to help push Ph.D. students on their way to undertaking research. Unlike most analytic Ph.D. courses, however, it does not focus on imparting specific techniques. Indeed, some Ph.D. students will feel they know the math tools already. Rather, the goal is to give students experience with applying tools to real issues, to thinking creatively beyond the presentation of the teacher, and to creating their own tools. Early in the semester, our TFs who are currently enrolled in Ph.D. programs will conduct a session discussing how Ph.D. and prospective Ph.D. students can get the most out of the course. An effective Ph.D. student should use the course to develop at least one solid idea for a research paper during the term.

OUTLINE OF CLASSES

I. **Introduction** – August 31, 2017

II. **Conceptual Thinking, Modeling, and Optimization** (6 Sessions)
    September 5   Conceptual Thinking and Modeling
    September 7   Simulation and Markov Chains
    September 12 Heterogeneity
    September 14 Lagrange Multipliers and Resource Economics
    September 19 Dynamic Optimization and Policy Decisions and High Shadow Price
                 Activities that Were Slighted
    September 21 Catch Up Day for Conceptual Thinking, Modeling, and Optimization

III. **Uncertainty, Information, and Risk Sharing** (5 sessions)
    September 26 through October 10

IV. **Behavioral versus Rational Economics** (6 sessions)
    October 12 through October 31

V. **Game Theory, Commitment, Interactive Decision, Social Choice** (6 sessions)
    November 2 through November 21

VI. **Organizing Society and Applications; Summing Up** (2 sessions)
    November 28 through November 30

VII. **Reading Period Assignment** (to be announced)

VIII. **Examination**
    Thursday, 12/7/17, 3:00-6:00 p.m. Location to be announced.
    3-hour Exam — some questions may be handed out in advance.

READING LIST I

August 31 - Introduction

September 5 - Conceptual Thinking and Modeling

R-A Ko, "Notes on Math Basics" (Read prior to first Math Review Session)

R-1 *Adams, "Introduction," and "Perceptual Blocks," Chapters 1 and 2, in *Conceptual Blockbusting*, pp. 1-11, 13-37. (optional)

R-2 Feynman, "The Relation of Mathematics to Physics," Chapter 2, in *The Character of Physical Law*, pp. 35-58.

R-3 *Schelling, "Micromotives and Macrobehavior," and "The Inescapable Mathematics of Musical Chairs," Chapters 1 and 2, in *Micromotives and Macrobehavior*. (Book is on reserve)

R-4 Gribbin, *Richard Feynman: A Life in Science*, excerpts.

Short Articles
S-1 Zeckhauser, "Statistics and Modeling"
S-2 Angier, "Mating for Life? It's Not for the Birds or the Bees"
S-3 Angier, "New View of the Role of Menstruation"
S-4 AP, "Emergency Room Gridlock"
S-5 Ravo, "As Deer Increase, Their Charm Fades"
S-6 Sterba, "Even a Real Genius Notes that Bambi is a Relevant Factor"
S-7 Schmidt, "Clash of Deer and Man Tests Public Ingenuity"
S-8 Foreman, "Ultrasound Benefit in Pregnancy Disputed"
S-9 Staff of *The Economist*, "The Puzzling Failure of Economics"
S-10 Staff of *The Economist*, "Play it Again, Samuelson"

September 7 - Simulation and Markov Chains

R-B Pollack, "Notes on Probability" (Read prior to second Math Review Session)

R-5 *"Markov Chains: Motivational Introduction"

R-6 *Stokey and Zeckhauser, "Markov Models," Chapter 7, in *A Primer for Policy Analysis*, pp. 98-114.

R-7 "Markov Chains"

R-8 Stokey and Zeckhauser, "Simulation," Chapter 6, in *A Primer for Policy Analysis*, pp. 89-97.

R-9 Hendricks, "Notes on Computer Simulations"

R-10 *"Marsh and McLennan" (A)

Short Articles
S-11 Culotta, "Forecasting the Global AIDS Epidemic"
S-12 Rees and Smith, "The End of Mandatory Retirement for Tenured Faculty"

S-13 Wofsey, "Technology"
S-14 Greer, "HMO Rates for Women Are Challenged"
S-15 Altman, "New Method for Analyzing Health Data Stirs Debate"

D-1 Discussion Problem of the Day: In the first class, we discussed briefly situations where severe policy disagreements result because individuals hold dramatically different models of the world. For this class, by Wednesday, September 6, at 2:00 p.m., submit <u>one paragraph</u> (online via Canvas course site) on a situation you have witnessed where policy disagreement related to individuals holding different models. (See Patt, "Economists and Ecologists: Modelling Global Climate Change to Different Conclusions," [posted Canvas course site], as a much more extended example.)

P-1 Problem of the Day: Steam Detector Problem (3-person collaboration permitted)

September 12 - Heterogeneity – <u>RECURRING THEME IN COURSE</u>

R-11 "Marsh and McLennan" (B) (will be posted on the Canvas course site later)

R-12 Pollack, "Notes on Heterogeneity and Measurement"

R-13 Bane and Ellwood, "Slipping Into and Out of Poverty: The Dynamics of Spells," *Journal of Human Resources*, vol. 21, no. 1, Winter 1986, pp. 1-23.

R-14 Zeckhauser, Sato, and Rizzo, "Hidden Heterogeneity in Risk: Evidence from Japanese Mortality," *Health Intervention and Population Heterogeneity*, December 1985, pp. 23-48.

D-2 Discussion Problem of the Day: Counting the Children in Katmandu

September 14 - Lagrange Multipliers and Resource Economics – <u>SHADOW PRICES, RECURRING THEME IN COURSE</u>

R-15 *"Programmed Exercises on Lagrange Multipliers"

R-16 Baumol, "Constrained Maxima: Lagrange Multipliers," Chapter 4, Section 8, in *Economic Theory and Operations Analysis*, pp. 62-67.

R-17 Pollack and Zeckhauser, "Budgets as Dynamic Gatekeepers," *Management Science*, vol. 42, no. 5, May 1996, pp. 642-658.

R-18 *Solow, "The Economics of Resources or the Resources of Economics," *American Economic Review*, vol. 64, no. 2, May 1974, pp. 1-14.

<u>Short Articles</u>
S-16 Kosterlitz, "Rationing Health Care"
S-17 Egan, "Oregon Lists Illnesses by Priority to See Who Gets Medicaid Care"
S-18 AP, "Oregon's Brave Medical Experiment"

P-2 Problem of the Day: Oregon Experiment. This problem may not be discussed in class. Whether it is or not, please complete it for your intellectual stimulation. Obviously, it is highly relevant given the debates about health care in the wake of the Patient Protection and Affordable Care Act (Obamacare).

Problem Set 1 to be distributed.

September 19 - Dynamic Optimization and Policy Decisions and High Shadow Price Activities that Were Slighted

R-19 Blumenthal and Zeckhauser, "The Artificial Heart as an Economic Issue," in *After Barney Clark*, pp. 149-167. (Make sure you understand the dynamic planning features in this article. Can you relate this in any way to the current debate over the use of stem cell technology?)

R-20 *Read, "Deterministic Reservoir Operation: An Application of the Economic Principles," New Zealand Ministry of Energy Report # ER4006.

R-21 *Epple and Lave, "Helium Policies," *Science*, vol. 225, 1984, pp. 784-785.

R-22 Patt, "Separating Analysis from Politics: Acid Rain in Europe," *Policy Studies Review*, vol.16, no. 3/4, 1999, pp. 104-137.

R-23 Trefil, "Modeling Earth's Future Climate Requires Both Science and Guesswork," *Smithsonian*, vol. 21, no. 9, December 1990, pp. 29-37.

R-24 *Keohane, Van Roy, and Zeckhauser, "Managing the Quality of a Resource with Stock and Flow Controls," *Journal of Public Economics*, vol. 91, no. 3-4, April 2007, pp. 541-569. (Read this to grasp essential elements, but do not attempt to wade through the math. Note the application of a model developed for the environment to other policy areas.)

Short Article

S-19 Zeckhauser, "Japanese and Korean Inventory Problem"

D-3 Discussion Problem of the Day: Bathroom Problem (This looks like a very mundane problem, though one that affects every member of this class. However, it illustrates many central issues in policy analysis. Often the best way to grasp some concept intuitively is by dealing with an everyday version, where we already have some intuitive feel.) **RECURRING THEME IN COURSE**)

September 21 - Catch Up Day for Conceptual Thinking, Modeling, and Optimization

R-25 Reilly et al., "Robbing Banks: Crime Does Pay – But Not Very Much," *Significance*, June 2012, pp. 17-21. We doubt that many of you are considering the profession evaluated in this article. We will use this article for another purpose: to see how to assess the returns from an activity. Be prepared to discuss the strengths and weaknesses of this analysis.

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R = Reading   S = Short piece (often newspaper article)   D = Discussion Problem
P = Problem of the Day
All readings are required unless noted as "optional." Introductions to central subjects or especially important readings are marked with an asterisk (*). Course materials are available online on the Canvas course site, except those that are noted as on reserve in the library.

Reading Lists II and III to follow.

API-302
ANALYTIC FRAMEWORKS FOR POLICY
Fall 2017

Master List of Readings - Part I

All readings listed below are officially required (i.e., should be read unless your friends are going out for beer) unless noted as optional (i.e., should not be read unless you are a glutton for punishment). Introductions to central subjects or especially important readings are marked with an asterisk. Be aware that you can read articles that you do not understand fully.

Section I. Introduction

Section II. Conceptual Thinking, Modeling, and Optimization

R-A   Ki-Seok Ko, "Notes on Math Basics." (manuscript)

R-B   Harold Pollack, "Notes on Probability." (manuscript)

R-1   *James Adams, "Introduction," Chapter 1, and "Perceptual Blocks," Chapter 2, in *Conceptual Blockbusting: A Guide to Better Ideas*, Reading, MA: Addison-Wesley, 1986, pp. 1-11, 13-37.

R-2   Richard Feynman, "The Relation of Mathematics to Physics," Chapter 2, in *The Character of Physical Law*, Cambridge, MA: MIT Press, 1967, pp. 35-58.

R-3   *Thomas C. Schelling, "Micromotives and Macrobehavior," Chapter 1, and "The Inescapable Mathematics of Musical Chairs," Chapter 2, in *Micromotives and Macrobehavior*, New York: W.W. Norton & Co., 1978, pp. 9-43, 45-80.

R-4   John Gribbin and Mary Gribbin, *Richard Feynman: A Life in Science*, New York: Dutton, 1997, excerpts on pp. 76-77, 88-89, 178-179, 196-197, 216-217.

R-5   *"Markov Chains: Motivational Introduction." (manuscript)

R-6   *Edith Stokey and Richard Zeckhauser, "Markov Models," Chapter 7, in *A Primer for Policy Analysis*, New York: W.W. Norton & Co., 1978, pp. 98-114.

R-7   "Markov Chains." (manuscript)

R-8   Edith Stokey and Richard Zeckhauser, "Simulation," Chapter 6, in *A Primer for Policy Analysis*, New York: W.W. Norton & Co., 1978, pp. 89-97.

R-9   Darryll Hendricks, "Notes on Computer Simulations." (manuscript)

R-10   *"Marsh and McLennan" (A). (Harvard Business School Case #9-171-303)

R-11   "Marsh and McLennan" (B). (Harvard Business School Case #9-175-290)

R-12   Harold Pollack, "Notes on Heterogeneity and Measurement." (manuscript)

R-13   Mary Jo Bane and David T. Ellwood, "Slipping Into and Out of Poverty: The Dynamics of Spells," *Journal of Human Resources*, vol. 21, no. 1, Winter 1986, pp. 1-23.

R-14   Richard J. Zeckhauser, Ryuzo Sato, and John Rizzo, "Hidden Heterogeneity in Risk: Evidence from Japanese Mortality," in *Health Intervention and Population Heterogeneity: Evidence from Japan and the United States*, National Institute for Research Advancement, December 1985, pp. 23-48.

R-15   *"Programmed Exercises on Lagrange Multipliers and Shadow Prices." (manuscript)

R-16   William Baumol, "Constrained Maxima: Lagrange Multipliers," Chapter 4, Section 8, in *Economic Theory and Operations Analysis*, Englewood Cliffs, NJ: Prentice-Hall, 1977, pp. 62-67.

R-17   Harold Pollack and Richard Zeckhauser, "Budgets as Dynamic Gatekeepers," *Management Science*, vol. 42, no. 5, May 1996, pp. 642-658.

R-18   *Robert M. Solow, "The Economics of Resources or the Resources of Economics," *American Economic Review*, vol. 64, no. 2, May 1974, pp. 1-14.

R-19   David Blumenthal and Richard J. Zeckhauser, "The Artificial Heart as an Economic Issue," in *After Barney Clark: Reflections on the Utah Artificial Heart Program*, Margery W. Shaw, ed., Austin: University of Texas Press, 1984, pp. 149-167.

R-20   *E. Grant Read, "Deterministic Reservoir Operation: An Application of the Economic Principles," New Zealand Ministry of Energy Report # ER4006, 1979.

R-21   *Dennis Epple and Lester Lave, "Helium Policies," letters, *Science*, vol. 225, 1984, pp. 784-785.

R-22   Anthony Patt, "Separating Analysis from Politics: Acid Rain in Europe," *Policy Studies Review*, vol.16, no. 3/4, 1999, pp. 104-137.

R-23   James Trefil, "Modeling Earth's Future Climate Requires both Science and Guesswork," *Smithsonian*, December 1990, vol. 21, no. 9, pp. 29-37.

R-24   *Nathaniel Keohane, Benjamin Van Roy, and Richard Zeckhauser, "Managing the Quality of a Resource with Stock and Flow Controls," *Journal of Public Economics*, vol. 91, no. 3-4, April 2007, pp. 541-569.

R-25   Barry Reilly, Neil Rickman, and Robert Witt, "Robbing Banks: Crime Does Pay – But Not Very Much," *Significance*, June 2012, pp. 17-21.

The following Reading List sections will be handed out at a later date: Section III. Uncertainty, Information, and Risk Sharing; Section IV. Behavioral versus Rational Economics; Section V. Game Theory, Commitment, Interactive Decision, Social Choice; and Section VI. Organizing Society and Applications