SYLLABUS FOR SPECIAL STUDIES AAEC6984: "ECONOMIC VALUATION OF ENVIRONMENTAL CHANGE" SPRING 2022

INSTRUCTOR: KLAUS MOELTNER

Contact Information:

office:	Hutcheson 303-B
phone:	(540)231-8249
e-mail:	moeltner@vt.edu

Course Information:

location:	HUTCH 207
time:	TR 11:00am - 12:15am
office hours:	TR, 1-2 pm or by appointment

Course Description and Objectives

This course gives a graduate-level introduction to the field of economic valuation, often also referred to as "nonmarket valuation." In essence, this research area deals with the tricky task of monetizing (= expressing in dollars or currency) environmental amenities and services, but also adverse environmental impacts, and - as such - environmental change. Traditionally, these monetized values then feed into a broader benefit-cost analysis of planned or proposed policy. While this field is traditionally considered a (vast) sub-discipline in environmental / applied economics, I believe its methods and tools are broadly applicable to any research area at the interface of environmental phenomena and change, and human activities and decision-making.

Therefore, my main goal with this course is to make economic valuation accessible to a broader audience of graduate students in the sciences, social sciences, engineering, or other disciplines. Its content will build on many applications and case studies that, within themselves, will be of interest to students within and outside of environmental economics. Examples include invasive species, wildfire smoke, highway noise, air pollution, water clean-up, flood risks, health impacts, wetland preservation, power outages, disappearing snow packs, and harmful algal blooms. We will discuss theoretical underpinnings and statistical methods to generate dollar-valued measures of societal benefits or costs related to the environment, but also illustrate how these estimates are subsequently used by policy makers and agencies to inform legislation and decision-making at various levels.

The course is application-driven and "hands-on" - utilizing data from various sources, such as GIS, remote sensing, project-specific surveys, and public environmental data repositories. Students will work through actual valuation projects, and answer real-world policy questions. Throughout the course, group work will be strongly encouraged.

In terms of statistical software, I will provide numerous empirical examples and problem sets in ***Python***, using Jupyter lab / notebook. I will provide installation / access instructions and tutorials, as well as links to web resources to facilitate the use of this statistical program on our Canvas course site. All statistical models will be estimated in a Bayesian framework, given its computational flexibility and applicability to data sets of any size. I will provide all necessary foundations on Bayesian estimation as part of this course, and lots of pieces of code and commands to get you started on your homework assignments (see below). In a nutshell, while the main focus of this course is on fundamentals and applications of economic valuation, you will pick up some handy skills in both Bayesian estimation and Python / Jupyter, which should serve you well in future courses as well as your research projects.

While the course stands on its own, it complements other advanced environmental economics courses offered at VT for those who wish to develop deeper expertise in this area. Examples include: AAEC 6524 "Environmental economic theory and practice" (taught by Prof. Wei Zhang in alternating spring semesters), FREC 5884 "Advanced natural resource economics" taught by Profs. Greg Amacher and Stella Schons (both FREC) in alternating fall semesters, and the newly developed course "Remote sensing for social scientists" by Prof. Elinor Benami (AAEC) - taught for the first time in fall 2021.

Prerequisites

In terms of content, this is an introductory course for PhD and Master's students, and no pre-existing knowledge of economic valuation topics or tools is required. In terms of quantitative methods and tools, however, a foundations in intermediate level statistics will be necessary and is thus required. Some background in intermediate micro-economics will be beneficial, but is not required. A solid grasp of fundamental algebra and some calculus are expected, and familiarity with computational software will be a plus. In essence, students should be able to take derivatives, have a basic understanding of statistical probabilities and distributions, and ideally have run a few regressions in the past.

Valid prerequisites offered at VT are: AAEC/ECON 5126 or any 5000-level statistics or econometrics course (offered through AAEC, ECON, STAT, or other departments), such as AAEC 5804, STAT 5304, STAT 5444, STAT 5044, STAT 5504, and STAT 5514. Please contact me if you are unsure about meeting these prerequisites. I am happy to discuss and consider equivalent alternatives.

Textbooks

Our primary resource for this course will be "*A Course in Environmental Economics: Theory, Policy, and Practice*" by Dan Phaneuf and Till Requate (Phaneuf and Requate, 2017). I will refer to this textbook henceforth as "*PR*."

A reading list of supplementary material, such as journal articles and book chapters will be posted on the Canvas course site as we move along.

In addition, I *recommend* the following optional textbooks for more background reading and to fill gaps that are not covered in the PR book.

Economic valuation.

(1) Hanley et al. (2007): Comes closest to the PR notes in breadth of topics, but is less technical. An ideal companion to the more technical PR notes. Henceforth referred to as "*HSW*"
(2) Kolstad (2011): Very accessible, modern text at the advanced undergraduate / beginning Master's level. Includes a plethora of interesting case studies. Useful if you want to brush up on intermediate-level economic modeling. Henceforth referred to as "*K*".
(3) Freeman et al. (2007): Still the leading text in nonmarket valuation at the advanced graduate level. Not the most user-friendly text, but fairly comprehensive with lots of useful references. Henceforth labeled as "*F*."
(4) Champ et al. (2017): Advanced undergraduate level treatment of nonmarket valuation. Written and edited by some of the most prolific researchers in the field. Henceforth labeled as "*CBB*".
(5) Louviere et al. (2000): Useful advanced text if you are seriously interested in stated preference methods (a sub-field of non-market valuation).

Bayesian econometrics.

(1) Koop et al. (2007): An applied Bayesian text that is light on theory and heavy on intuition, examples, and practice. Geared towards economists / social scientists.
(2) Koop (2003). Similar to Koop et al. (2007), but with more details on methodologies and techniques.
(3) Gelman et al. (2004). A comprehensive, all-around reference for Bayesian methods. Nice appendix with explicit forms for many density functions.
(4) Hoff (2009): Very accessible introductory text, with detailed derivations.

Grading and Other Administrative Issues

Assignments and Grading. There will be five "problem sets," or "projects." All count for 30 points each, for a total of 150 possible points. The last project has to be handed in during the time slot of our final exam (May 11, 1:05 - 3:05 pm). I will grade on a curve, with 85-90% of the high score marking the threshold for an "A." Group work is encouraged for the first four assignments. The final project has be completed through individual, independent work.

Student conduct. The Virginia Tech honor system applies to all graded work in this course. For more information, visit http://www.honorsystem.vt.edu

Students with disabilities. Please let me know if you have a documented disability, so we can provide any accommodations you may need.

References

Champ, P., Boyle, K. and Brown, T. (2017). *A Primer on Nonmarket Valuation*, 2 edn, Springer.

Freeman, A. I., Herriges, J. and Kling, C. (2007). *The Measurement of Environmental and Resource Values: Theory and Methods*, 3rd edition edn, Resources for the Future Press.

Gelman, A., Carlin, J., Stern, H. and Rubin, D. (2004). *Bayesian Data Analysis*, 2nd edn, Chapman & Hall/CRC.

Hanley, N., Shogren, J. and White, B. (2007). *Environmental Economics in Theory and Practice*, 2nd edition edn, Palgrave / MacMillan.

Hoff, P. (2009). *A first course in Bayesian statistical methods*, Springer.

Kolstad, C. (2011). *Environmental Economics*, 2nd edition edn, Oxford University Press.

Koop, G. (2003). *Bayesian Econometrics*, Wiley.

Koop, G., Poirier, D. and Tobias, J. (2007). *Bayesian Econometric Methods*, Cambridge University Press.

Louviere, J., Hensher, D. and J.D., S. (2000). *Stated Choice Methods: Analysis and Applications*, Cambridge University Press.

Phaneuf, D. and Requate, T. (2017). *A course in Environmental Economics: Theory, Policy, and Practice*, 1st edition edn, Cambridge University Press.

Semester Schedule for Econ. Valuation, Spring 2022
(subject to adjustments)

Modules	Dates	Topic	References	Assignments
Part I): Foundations		**Theoretical and Statistical Foundations**		
Module 1	Jan. 18, 20	Utility and welfare measures	PR 14, CBB 1,2	
Module 2	Jan. 25, 27 Feb. 1,3	Bayesian foundations and methods	KPT 1-2; 5; 11	
Part II)		**Stated preference methods and applications**		
Module 3	Feb. 8, 10	Survey design and best practices		PS 1 due Feb. 10
Module 4	Feb. 15, 17	Contingent valuation models	PR 19, CBB 3-5	
Module 5	Feb. 22, 24 Mar. 1, 3	Choice experiments		
Part III):		**Property valuation methods and applications**		
	Mar. 15, 17	Methods		PS 2 due Mar. 17
Module 6	Mar. 22, 24 Mar. 29, 31	Applications	PR 18, CBB 7	
Part IV):		**Recreation demand methods and applications**		
Module 7	Apr. 5, 7	Travel cost method / models	PR 17, CBB 6	PS 3 due Apr. 7
	Apr. 12, 14	Applications		
Part V)		**Benefit Transfer methods and applications**		
	Apr. 19, 21	Methods		PS 4 due Apr. 21
Module 8	Apr. 26, 28 May 3	Applications	PR 22, CBB 11	
16	May 11	final exam, 1:05-3:05 pm		Final project due

K=Koop, KPT=Koop et al., PR=Phaneuf/Requate, CBB = Champ et. al