Applied Econometrics of Resource and Energy Demand
AAE 772 (4 credits)
Spring 2020
UW-Madison

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Course Description
The primary goal of this course is to provide students with the skills necessary to apply econometric analysis to issues in resource and energy demand, including:

- Econometric analysis of the impacts of demand-side resource/energy programs, with an emphasis on advances in experimental and quasi-experimental methods.
- The application of discrete choice econometrics to discrete choice experiments (conjoint analysis, contingent valuation) and program participation data.
- Forecasting resource and energy demand.

Much of the course focuses on panel data methods because panel data is commonly available in demand-side energy/resource analysis. Moreover, lectures and problem sets focus on program/policy evaluation, which is arguably the most common purpose of econometric analysis in both the current academic literature and professional work. A strong understanding of this type of analysis fosters a style of thinking about econometric analysis that is broadly useful.

All material in the course is posted on the course Canvas page. I expect to post lecture notes the evening before lecture, and problem sets the evening before they are assigned.

Learning Outcomes
After completing this course, students will be able to:
1. Estimate linear regression models and interpret the results,
2. Estimate discrete choice models and interpret the results,
3. Evaluate forecasting models,
4. Select the experimental or quasi-experimental method appropriate for the analysis at hand.
**READINGS**

The course will draw primarily on material from the following textbooks. There is no required reading, but you might want to consult these texts to supplement the material covered in lecture.


In addition, I will post on Canvas those papers to which I refer in lecture.

**GRADING**

Grades will be based on problem sets (50%), and three exams (50%).

This is an intensive course and you must keep up with the work to do well. We meet for 4 hours per week (including lectures and discussions).

Targeted grade distribution:

- $\geq 93\%$  
  A
- $< 93\% \& \geq 88\%$  
  AB
- $< 88\% \& \geq 83\%$  
  B
- $< 83\% \& \geq 78\%$  
  BC
- $< 78\% \& \geq 70\%$  
  C
- $< 70\% \& \geq 60\%$  
  D
- $< 59\%$  
  F

**TOPICS SCHEDULE (Approximate)**

- Week 1: Review, selection bias, randomized controlled trials (RCTs) in program evaluation
- Week 2: Basic models for estimating treatment effects in RCTs
- Week 3: Fixed effects and lagged dependent variable models in the context of RCTs
- Week 4: Treatment effect heterogeneity, bad controls, and other issues in program evaluation with RCTs
- Week 5: Nonspherical disturbances and robust standard errors
- Week 6: Intro to program evaluation with observational data, I
- Week 7: Intro to program evaluation with observational data, II
- Week 8: Matching with regression analysis
- Week 9: Instrumental variable methods I
- Week 10: Instrumental variable methods II
- Week 11: Discrete choice models I
Week 12: Discrete choice models II

Week 13: Extending maximum likelihood estimation

Week 14: Forecasting

**QUIZ SCHEDULE**

Feb 21: Quiz 1 covers material in weeks 1-4, first 2 problem sets
Apr 3: Quiz 2 covers material in weeks 5-9, problem sets 3-5
May 4: Quiz 3 covers material in weeks 10-14, problem sets 6-9

**ASSIGNMENTS**

Assignments will be posted on Wednesdays and due by the end of the day the following **Wednesday**. Discussion sections on Fridays and Mondays will provide an opportunity to get help/advice from Pukitta and Qinan. All econometric work must be done in R. We expect that Friday discussion sections will review lecture material and provide you with a few R coding tips to help you with the week’s problem set. The second discussion section on Monday will provide Pukitta time to respond to questions you have about the homework (email her **before** discussion to help her understand what material to cover!).

All written material must be typed, not handwritten. This includes equations; get to know how to use the equation editor in MS-Word. All problem set material must be uploaded as either (a) R markdown files along with versions of R markdown knitted to pdf, html, or MS-Word; or as (b) MS-Word documents with R files. Pukitta will clarify our expectations for the problem sets in discussion section.

Problem set and quiz schedule:

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<thead>
<tr>
<th>Exercise</th>
<th>Problem set topic</th>
<th>Problem set posted</th>
<th>Problem set discussed in section</th>
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<td>Week 1</td>
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<td>1 Week 2</td>
<td>RCT Consistency/Diff estimator/DID estimator</td>
<td>Jan 29</td>
<td>Jan 31, Feb 3</td>
<td>Feb 5</td>
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<td>2 Week 3</td>
<td>RCT Consistency/2-way fixed effects/LDV</td>
<td>Feb 5</td>
<td>Feb 7, Feb 10</td>
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<td>Week 4</td>
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<td>Week 5</td>
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<td>Quiz covering weeks 1-4 during discussion on Feb 21</td>
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<td>3 Week 6</td>
<td>Nonspherical errors and heterogenous treatment effects</td>
<td>Feb 26</td>
<td>Feb 28, Mar 2</td>
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<td>4 Week 7</td>
<td>Estimating treatment effects with observational data</td>
<td>Mar 4</td>
<td>Mar 6, Mar 9</td>
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<td>5 Week 8</td>
<td>Matching with regression</td>
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<td>6 Week 9</td>
<td>Matching with regression II</td>
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<td>Mar 27, Mar 30</td>
<td>Apr 1</td>
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<td>Quiz covering weeks 5-9 during discussion on April 3</td>
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<td>Week 10</td>
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<td>7 Week 11</td>
<td>IV using the Week 9 data</td>
<td>Apr 1</td>
<td>Apr 10, Apr 13</td>
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<td>8 Week 12</td>
<td>Discrete choice</td>
<td>Apr 15</td>
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<td>Week 15</td>
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<td>Quiz covering weeks 10-14 during discussion time May 4</td>
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**A NOTE ON COVERAGE OF DISCRETE CHOICE ECONOMETRICS**

Students who took AAE 777 have already covered a considerable amount of material on discrete choice (the topic covered in weeks 11-12 and problem set 8). These students will receive different material and a different problem set and a slightly different version of the third quiz than students who have not taken AAE 777. I have not yet worked out the details of this, but will do so before spring break.