Spring 2018 **Harry J. Paarsch**

University of Central Florida
Department of Economics

ECO 6315
Seminar in Contemporary Economic Issues

Syllabus

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Office Hours: Right after the seminar.

Prerequisites: Successful completion of ECO 6403, ECO 6118, and ECO 5445. In other words, demonstrated competence in mathematical economics and microeconomic theory as well as how the tools developed in those courses apply to business analytics is required.

Textbooks: *A Course in Behavioral Economics*, 2nd ed., by Erik Angner. New York: Palgrave Macmillan, 2016.

Algorithms to Live By: The Computer Science of Human Decisions, by Brian Christian and Tom Griffiths. New York: Henry Holt and Company, 2016.

Requirements: Seminar attendance and participation as well as three presentations You will also be required to complete several problem sets and write a term paper.

Grading: Together, attendance and participation will account for 15 percent of your grade. The presentations will account for 30 percent, while the problem sets will account for 25 percent, and the term paper the remaining 30 percent.

Group Work: You are encouraged to discuss seminar material, the problem sets, and your term paper with others, but you must write up the fruits of those discussions by yourself.

University of Central Florida
Department of Economics

ECO 6315
Seminar in Contemporary Economic Issues

Syllabus (continued)

Important: Students are expected to be familiar with the University's standards regarding academic integrity and academic misconduct, as well as the course of action that will be taken if a violation occurs; these links

`http://goldenrule.sdes.ucf.edu/`

and

`http://osc.sdes.ucf.edu`

provide such information. Information on accommodations for those with disabilities may be found at

`http://sds.sdes.ucf.edu/`

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ECO 6315
Seminar in Contemporary Economic Issues

Additional Information

Neoclassical economics is built on a foundation of three hypotheses: (1) scarcity, (2) optimization, and (3) equilbrium. Of the three, the hypothesis of scarcity is obviously the least controversial. It can verified just by looking at the world around you; scarcity exists in every part of life. To many non-economists, the hypothesis of optimization is considered the Achilles' heal of economics, but I believe that this is a mistaken view: the hypothesis of optimization has no empirical content; there always exists an objective function that can reconcile the observed data. When people object to the hypothesis of optimization in economics, typically what appears to concern them are assumptions concerning specific objective functions, such as profit or utility. Such functions put amazing structure on problems, which in turn deliver very sharp predictions.

Without question, however, the most restrictive of the triad is the hypothesis of equilibrium, which is indeed unfortunate. First, economists currently have only a few notions of equilibrium to use. Second, none of the notions does consistently well empirically. Moreover, in many applications, particularly in the field of industrial organization, the hypothesis of equilibrium is often used to identify an empirical model, so it can't even be tested. In short, the hypothesis of equilibrium is quite restrictive. That is why, whenever possible, applied economists try to avoid invoking the hypothesis of equilibrium, being content to try to make predictions simply using scarcity as well as a reasonable objective function.

Much of the research in behavioral economics is devoted to pointing out that certain functional-form assumptions made when implementing the hypothesis of optimization are violated in reality. Such observations are clearly important steps toward fleshing out more complete explanations of observed data, but this research in no way undermines the general approach taken by economists when solving problems. In other words, such observations simply refute a maintained hypothesis (for example, profit maximization), not the entire infrastructure that is economics.

From the perspective of a business analyst, however, the violations observed by behavioral economists are a boon. For instance, if your firm has some objective that other participants in a market do not share, then you and your firm can benefit by using business analytics to trade against those whose objectives are different. To a large extent, this was the imperfection that Billy Beane exploited at the Oakland A's: some (many) scouts in baseball considered important factors that are surely irrelevant when considering an athlete's potential ability to play professional baseball, such as how good looking his girlfriend is. By focusing on base hits, Billy Beane and his staff ignored such factors: get enough of them and you will score runs; score enough runs and you have a better chance of winning; win enough games and you might get to the World Series; get to the World Series, and you could become World Champions. Thus, in principle, business analytics can help you construct decision rules that capture the objectives of the firm, thus avoiding the biases of others.

This seminar is devoted to examining some of the ways in which real economic actors do not behave as assumed. The bulk of the seminar will involve each of you presenting the work of others at least three times. The topics and dates of the presentations will be determined by a lottery, but you may recontract: in other words, if two of you want to trade, then you can, but you need to notify me first.

Practically speaking, one week before the date of your seminar presentation, you will be required to create a PDF file containing the compiled Beamer slides of that presentation. On the date in question, you will guide the seminar using your slides as a road map; your well-informed colleagues will ask you questions and provide alternative interpretations. In other words, both sides will be scored—the presenter for his curation of the information in the reading for that day, the members of the audience for their comments and questions concerning the presentation.

Because you will need some time to read, digest, and develop your presentations, in the first five or six weeks of the seminar, I shall present some empirical and theoretical work that I hope will be helpful to you in your work.

In addition to the three mandatory presentations, several problem sets and a term paper are required as well. All of these task are mandatory. In other words, you cannot get credit for this seminar without having completed all of these tasks successfully. Morover, in addition to participation in the seminar, daily attendance will be graded as well.

In seminars, I presume that students have read the work assigned for that day. To help you prepare for each seminar, I have attached a list of the topics I intend to cover over the next fifteen weeks. I urge you to read avidly prior to attending seminars because we have a lot of ground to cover; you cannot afford to get behind in your reading.

That said, neither the discussions in the seminar nor reading the textbooks will be self-sufficient for an adequate understanding of the material. Parts of the discussions in the seminar will involve material not in the textbook and parts of the textbook will not be discussed in the seminars. Thus, you are expected to read widely—hence the reading list.

Irregular attendance or inattentiveness during the seminar will almost surely result in a poor grade; that is, success will require attention and participation. To this end, please turn off and put away cell phones as well as laptops, tablets, and other electronic devices or toys during class, unless asked to do otherwise. Also, please notify me if you plan to be absent.

Spring 2018 **Harry J. Paarsch**

University of Central Florida
Department of Economics

ECO 6315
Seminar in Contemporary Economic Issues

Readings

1. Popular Books

1.1 *The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations*, by James Surowiecki. New York: Little, Brown, 2004.

1.2 *The Signal and the Noise*, by Nate Silver. New York: Penguin Books, 2012.

1.3 *Moneyball: The Art of Winning an Unfair Game*, by Michael Lewis. New York: W. W. Norton & Company, 2004.

1.4 *The Undoing Project: A Friendship that Changed Our Minds*, by Michael Lewis. New York: W. W. Norton & Company, 2017.

1.5 *Misbehaving: The Making of Behavioral Economics*, by Richard H. Thaler. New York: W. W. Norton & Company, 2015.

1.6 *Nudge: Improving Decisions about Health, Wealth, and Happiness*, by Richard H. Thaler and Cass R. Sunstein. New Haven, CT: Yale University Press, 2008.

1.7 *Predictably Irrational: The Hidden Forces that Shape Our Decisions*, by Dan Ariely. New York: Harper-Collins Publishers, 2008.

1.8 *Thinking, Fast and Slow*, by Daniel Kahneman. New York: Farrar, Straus and Giroux, 2011.

2. Scholarly Articles on Behavioral Economics

2.1 Edwards, Ward. "The Theory of Decision Making," *Psychological Bulletin*, 51, (1954), 380–417.

2.2 May, Kenneth O. "Intransitivity, Utility, and the Aggregation of Preference Patterns," *Econometrica*, 22 (1954), 1–13.

2.3 Ellsberg, Daniel. "Risk, Ambiguity, and the Savage Axioms," *Quarterly Journal of Economics*, 75 (1961), 643–669.

2.4 Tversky, Amos and Daniel Kahneman. "Belief in the Law of Small Numbers," *Psychological Bulletin*, 76 (1971), 105–112.

2.5 Kahneman, Daniel and Amos Tversky. "Subjective Probability: A Judgment of Representativeness," *Cognitive Psychology*, 3 (1972), 430–454.

2.6 Tversky, Amos and Daniel Kahneman. "Availability: A Heuristic for Judging Frequency and Probability," *Cognitive Psychology*, 5 (1973), 207–232.

2.7 Kahneman, Daniel and Amos Tversky. "On the Psychology of Prediction," *Psychological Review*, 80 (1973), 237–251.

2.8 Tversky, Amos and Daniel Kahneman. "Judgment under Uncertainty: Heuristics and Biases," *Science*, 185 (1974), 1124–1131.

2.9 Kahneman, Daniel and Amos Tversky. "Prospect Theory: An Analysis of Decision under Risk," *Econometrica*, 47, (1979), 263–291.

2.10 Tversky, Amos and Daniel Kahneman. "Rational Choice and the Framing of Decisions," *Journal of Business*, 59 (1986), S251–S278.

3. Other Articles and Books, Both Popular and Scholarly

3.1 Lehrer, Jonah. "The Truth Wears Off," *New Yorker*, 13 December 2010, 52–58.

3.2 Lucas, Robert E. "Econometric Policy Evaluation: A Critique," in *Carnegie-Rochester Conference Series on Public Policy*, Volume 1, edited by Karl Brunner and Alan Meltzer. New York: Elsevier, 1976.

3.3 Rothenberg, Thomas J. "Incredible Structural Inference," in *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*, edited by Donald W. K. Andrews and James H. Stock. New York: Cambridge University Press, 2005.

3.4 Hubbard, Timothy P. and Harry J. Paarsch. *Auctions*. Cambridge, MA: MIT Press, 2015.

3.5 Gentry, Matthew L., Timothy P. Hubbard, Denis Nekipelov, and Harry J. Paarsch. "Structural Econometrics of Auctions: A Review," *Foundations and Trends ® in Econometrics*, (forthcoming).

3.6 Chade, Hector, Jan Eeckhout, and Lones Smith. "Sorting through Search and Matching Models in Economics," *Journal of Economic Literature*, 55 (2017), 493–544.

3.7 Akerlof, George A. and Robert J. Schiller. *Phishing for Phools: The Economics of Manipulation and Deception*. Princeton, NJ: Princeton University Press, 2015.

3.8 Evans, David S. and Richard Schmalensee. *Matchmakers: The New Economics of Multisided Platforms*. Boston: Harvard Business Review Press, 2016.

University of Central Florida
Department of Economics

ECO 6315
Seminar in Contemporary Economic Issues

Timetable

Date	Topic; Reading; Problem set due?	
01/13	Auctions, Chs. 1 & 2 in H & P; Chs. 1 & 2 in Angner.	
01/20	Auctions, Chs. 3 & 4 in H & P; Chs. 3 & 4 in Angner; PS#1 due.	
01/27	Auctions, Chs. 5 & 6 in H & P; Chs. 5 & 6 in Angner; PS#2 due.	
02/03	Auctions, Chs. 7 & 8 in H & P; Chs. 7 & 10 in Angner; PS#3 due.	
02/10	Structural Econometrics of Auctions, Lucas as well as Gentry et al.; PS#4 due.	
02/17	Limitations of Structural Econometrics, Rothenberg; Ch. 11 in Angner; PS#5 due.	
02/24	Presentations; term paper topics due.	
03/03	Presentations.	
03/24	Presentations; term paper outlines due.	***Double Session***
03/31	Presentations.	***Double Session***
04/07	Presentations.	
04/14	Presentations.	
04/21	Presentations.	***Double Session***
04/28	Term papers due.	

Spring 2018 **Harry J. Paarsch**

University of Central Florida
Department of Economics

ECO 6315
Seminar in Contemporary Economic Issues

Problem Set #1

1. Consider the function
$$\pi(x) = \log x - x, \quad x > 0.$$
   a) Graph the functions x, $\log x$, and $\pi(x)$ against x.
   b) Find x^*, the maximum of $\pi(x)$ with respect to x.

2. Consider the following complete integral:
$$\int_a^b y \exp(-y) \ \mathrm{d}y,$$
where a and b are known constants.
   a) Use the technique known as *integration-by-parts* to solve this integral. Consider as a hint the following equation:
$$\int u \ \mathrm{d}v = uv - \int v \ \mathrm{d}u$$
and remember that
$$u = \int \mathrm{d}u.$$
For example,
$$-\exp(-y) = \int \exp(-y) \ \mathrm{d}y,$$
while
$$y = \int \mathrm{d}y.$$
   b) Solve this integral when a is zero and b is infinity. Consider as a hint, *l'Hôpital's rule*, which states that if $\lim_{x\to c} \ f(x) = \lim_{x\to c} \ g(x) = 0$ (or $\pm\infty$) and if
$$\lim_{x\to c} \frac{f'(x)}{g'(x)}$$
exists, then
$$\lim_{x\to c} \frac{f(x)}{g(x)} = \lim_{x\to c} \frac{f'(x)}{g'(x)}.$$

3. Consider the following differential equation:

$$\frac{\mathrm{d}y}{\mathrm{d}x} = x.$$

a) Find the general solution to this differential equation.

b) If y_0 is one when x_0 is zero, then find the exact solution to this differential equation.

4. Suppose

$$f_V(v) = \begin{cases} 1 & \text{for } 0 \leq v \leq 1, \\ 0 & \text{otherwise.} \end{cases}$$

Find the cdf as well as the mean and variance of V.

5. Suppose N valuations are drawn independently from

$$f_V(v) = \begin{cases} 1 & \text{for } 0 \leq v \leq 1, \\ 0 & \text{otherwise.} \end{cases}$$

Consider $Z = \max(V_1, V_2, \ldots, V_N)$, the maximum of these N draws.

a) Find the cdf as well as the pdf of Z.

b) Find the mean and variance of Z.

Due Date: Saturday, 20 January 2018, at the beginning of the seminar.

Spring 2018 **Harry J. Paarsch**

University of Central Florida
Department of Economics

ECO 6315
Seminar in Contemporary Economic Issues

Problem Set #2

1. Suppose that output q is produced using factor inputs h and ℓ using the following *Leontief* production function:
$$q = \min(\alpha h, \beta \ell) \quad \alpha,\ \beta > 0$$
where the factor-input prices of h and ℓ are w and s, respectively.

   a) Sketch representative isoquants for q in (ℓ, h)-space. Provide interpretations for α and β. Predict what the scale and output effects will be for this technology.

   b) Derive the total C and marginal m cost functions for this technology, and sketch them in (q, C)- and (q, m)-space, respectively.

2. Explain what the purpose of game theory is and describe its two main branches. Outline the elements common to all games. Describe at least two notions of equilibrium used to solve games. Provide two examples from the world around you that can be cast as games.

3. Two children, A and B, have broken a vase that their mother really liked. If neither confesses to the accident (Silence), then each will be punished heavily, while if either A or B tells on the other, then the tattletale will get no punishment, while the child implicated will be punished heavily. If both confess to the accident, then each will be punished lightly. The pay-off matrix of this game is as follows:

$$\begin{array}{ccc} & & \text{Child B} \\ & & \begin{array}{cc} \text{Confess} & \text{Silence} \end{array} \\ \text{Child A} & \begin{array}{c} \text{Confess} \\ \text{Silence} \end{array} & \begin{pmatrix} (-1,-1) & (\ \ 0,-2) \\ (-2,\ \ 0) & (-2,-2) \end{pmatrix} \end{array}$$

where the first term in parentheses in any cell is the pay-off to child A from choosing the action in that row of the matrix, while the second term in parentheses in any cell is the pay-off to child B from choosing the action in that column of the matrix.

   a) Predict the equilibrium outcome to this game. What kind of an equilibrium is this?

Now suppose the punishment structure is changed. If neither confesses to the accident (Silence), then each will be punished lightly, while if either A or B tells on the other, then the tattletale will get punished heavily, while the child implicated will receive no punishment. If both confess to the accident, then neither will be punished. The pay-off matrix of this game is as follows:

$$
\begin{array}{ccc}
 & & \text{Child B} \\
 & & \begin{array}{cc} \text{Confess} & \text{Silence} \end{array} \\
\text{Child A} & \begin{array}{c} \text{Confess} \\ \text{Silence} \end{array} & \begin{pmatrix} (0, \ \ 0) & (-2, \ \ 0) \\ (0, -2) & (-1, -1) \end{pmatrix}
\end{array}
$$

b) Predict the equilibria to this game. What kind of equilibria are they?

4. Explain how you represent incomplete information in an extensive-form game and provide two examples from economics of phenomena involving incomplete information.

Due Date: Saturday, 27 January 2018, at the beginning of the seminar.

Spring 2018 **Harry J. Paarsch**

University of Central Florida
Department of Economics

ECO 6315
Seminar in Contemporary Economic Issues

Problem Set #3

1. Within the IPVP, assume N potential bidders as well as

$$F_V(v) = v \quad \forall\ v \in [0,1]$$

so

$$f_V(v) = 1 \quad \forall\ v \in [0,1].$$

   a) Find $\sigma(v)$, the Bayes–Nash, equilibrium bid function at a sealed, pay-your-bid auction.
   b) Find the pdf of $Y = V_{(2:N)}$.
   c) Find the cdf of Y.
   d) Find the mean of Y.
   e) Find the variance of Y.
   f) Find the cdf of $Z = V_{(1:N)}$.
   g) Find the pdf of Z.
   h) Find the mean of Z.
   i) Find the variance of Z.
   j) Find the pdf of the winning bid W at a sealed, pay-your-bid auction where $W = \sigma[V_{(1:N)}]$.
   k) Find the mean of W.
   l) Find the variance of W.

2. Within the IPVP environment assumed above, assume a positive reserve price r which is less than one.

   a) Find $\sigma(v)$, the Bayes–Nash, equilibrium bid function at a sealed, pay-your-bid auction.
   b) Find the pmf of the number of participants M at both English and sealed, pay-your-bid auctions.
   c) Find the optimal reserve price ρ^*.

Due Date: Saturday, 3 February 2018, at the beginning of the seminar.

Spring 2018 **Harry J. Paarsch**

University of Central Florida
Department of Economics

ECO 6315
Seminar in Contemporary Economic Issues

Problem Set #4

1. Within the IPVP environment of Problem Set #3, assume that each potential bidder has a von Neumann–Morgenstern utility function

$$U(Y;\eta) = \eta Y^{1/\eta} \quad \eta \geq 1.$$

   a) Find $\beta(v)$, the dominant-strategy equilibrium-bid function at an English auction.
   b) Find $\sigma(v)$, the Bayes–Nash, equilibrium-bid function at a sealed, pay-your-bid auction.
   c) Find the pdf of the winning bid W at a sealed, pay-your-bid auction where $W = \sigma[V_{(1:N)}]$.
   d) Find the mean of W.
   e) Find the variance of W.
   f) Which mechanism would a risk-neutral seller prefer? Why?

2. Consider an all-pay auction of an indivisible object where N bidders submit sealed bids simultaneously. At an all-pay auction, each bidder pays what he has bid, but only the highest bidder wins the object. Assume that the bidders' valuations are independent draws from the uniform distribution on the interval $[0, 1]$ and that bidders are risk neutral.

   a) Write down the expected pay-off function of a representative bidder.
   b) Characterize the necessary, first-order condition for optimal bidding.
   c) Find the symmetric, Bayes–Nash equilibrium bidding strategy.
   d) How does the seller's revenue in this auction compare to that of a first-price, sealed-bid auction?

Due Date: Saturday, 10 February 2018, at the beginning of the seminar.

Spring 2018 **Harry J. Paarsch**

University of Central Florida
Department of Economics

ECO 6315
Seminar in Contemporary Economic Issues

Problem Set #5

1. Suppose that the logarithm of the valuation for a potential buyer $\log V$ is distributed normally with mean μ and variance σ^2. Consider a sequence of Vickrey auctions $t = 1, \ldots, T$ each having no reserve price, so all N_t potential bidders participate. Suppose only the winning bid W_t and N_t are recorded. Thus, the researcher receives the sequence $\{(w_t, N_t)\}_{t=1}^{T}$.

   a) Assuming that valuations are independently and identically distributed, derive the cumulative distribution function of winning bid W_t in terms of the cumulative distribution function $\Phi(z)$ for a standard normal random variable as well as N_t. Also, derive the probability density function of W_t, using $\phi(z)$ to denote the probability density function for a standard normal random variable.
   b) Derive the expectation of $\log W_t$. (Hint: note that the normal random variable $\log V$ lives within the location-scale family of random variables, so $\log V$ equals $\mu + \sigma Z$, which means that $\log W_t$ equals $\mu + \sigma Z_{(2:N_t)}$.)
   c) Write down the logarithm of the likelihood function for a sample of size T.
   d) Write down the regression equation for $\log W$.

2. Consider a government that seeks to perform a task at the lowest cost. It requests sealed-bid tenders from a group of N potential suppliers and, assuming that no reserve price is imposed, uses as the selection rule that the lowest bidder will win the auction. Suppose that the cost of performing the service for any one bidder C is an independently and identically distributed draw from a distribution $F_C(c)$ which is common knowledge to all potential bidders, and that potential suppliers behave noncoöperatively. Assume that potential suppliers are risk neutral with regard to winning the right to perform the task for the government.

   a) Calculate the symmetric, Bayes-Nash equilibrium-bid function for a generic bidder at the auction. In the course of this calculation, be sure to highlight where you have used the assumptions of independence, symmetry, and Bayes-Nash behavior.
   b) Assuming that the distribution of unobserved heterogeneity is from the Pareto family having cumulative distribution function

   $$F_C(c|\theta_0^0, \theta_1^0) = 1 - \left(\frac{\theta_0^0}{c}\right)^{\theta_1^0} \qquad c > \theta_0^0 > 0,\ \theta_1^0 > 0$$

   where θ_0^0 and θ_1^0 are parameters, calculate the equilibrium bid function.
   c) Derive $f_W(w|\theta_0^0, \theta_1^0, N)$, the probability density function of the winning bid W, at an auction and characterize its support.

Consider a sample of T auctions at which for auction t both the the number of potential competitors N_t and the winning bid w_t are observed.

d) For the sample $\{(N_t, w_t)\}_{t=1}^{T}$, derive the logarithm of the likelihood function and explain why the method of maximum likelihood as conventionally applied does not apply to this problem.

e) Write down the constrained optimization problem, the solution to which defines $\hat{\boldsymbol{\theta}}$, the maximum-likelihood estimator of $\boldsymbol{\theta}^0$, which equals the vector $(\theta_0^0, \theta_1^0)^\top$. Explain how you would implement this estimator. (Hint: be as precise as you can concerning what kind of problem you are solving, and why your proposed method of solution will give the correct optimum.)

Due Date: Saturday, 17 February 2018, at the beginning of the seminar.