Economics of Auctions
ECO 395K

Prof. Jorge Balat
BRB 3.134B
jbalat@utexas.edu

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1 Course Description and Objectives

There is a myriad of market mechanisms to allocate resources that can be classified as auctions. These are currently used in various markets ranging from art objects to fresh fish, from electricity to treasury bonds, and from government procurement to internet ads.

This course has three main objectives. First, students will learn how these various market mechanisms work. We will discuss the theoretical foundations behind them, and their properties, as well as explore many real-world applications. We will use game theory to analyze bidders' strategic interaction and characterize their behavior. Second, students will learn how the auction rules can be modified to attain specific objectives and to derive policy recommendations. Finally, students will learn the recent empirical methods to analyze auction data needed to conduct research in auctions.

This class is designed for students with a strong quantitative background. Since the work of Vickrey (1961), we can think of auctions as an application of games of incomplete information and, thus, this class is a complement to Game Theory. I will not assume any knowledge of game theory and will spend the first part of this course introducing all the necessary concepts of game theory. Even though we will discuss many real-world applications, you can expect this class to be on the theoretical side.

After the introduction to Game Theory, we will examine the theoretical models behind the most commonly used auction formats: English, Dutch, first- and second-price. Students will learn the core theoretical results and will be exposed to recent empirical research in auctions. We will then spend some time discussing topics in auction design. Next, students will be introduced to the state-of-the-art empirical approaches to analyze auction data. Finally, we will discuss more advanced topics including multi-unit and internet auctions.

2 Administrative Info

- The class meets on Tue and Thu 12:30 - 2:00 PM in BRB 2.136.
- Contact information

email	`jbalat@utexas.edu`
Office Hours	TBA

- Teaching assistant: Justin Latona

email	`justin.latona@utexas.edu`
Office Hours	TBA

- It is your responsibility to frequently check the course webpage on Canvas for announcements, assignments, and other material.
- Any part of this syllabus is subject to change.

3 Requirements and Grading

Class Participation and Readings (10%) Active student participation is essential to a successful learning environment. Students are expected to complete the reading assignments before each class and participate in the discussions. I will ask questions and encourage you to ask questions as well. There may be short quizzes for some of the assigned readings.

Problem Sets (20%) There will be regular problem sets assigned throughout the semester. The problem sets are designed to give the students an opportunity to review and enhance the material learned in class. Problem sets will be posted on the course web page and will be administered via *Gradescope*. You are responsible for regularly checking the course website and being aware of the problem set deadlines. *Late submissions are not accepted.* However, the problem set with the lowest grade will be dropped when computing the course grade.

Students are encouraged to form small study groups. At the stage when you are figuring out how to do a homework problem, you are welcome to discuss with others how to set up the problem, and the strategy for solving it. Once you've solved the problem, you are welcome to compare your answer with those of others, and to discuss the sources of any differences between your answers. However, each student is expected to write up their own answers independently. If your answer(s) and those of another student are identical or too similar, this may be taken as evidence that you have not written up your answers independently. Should "copying" occur, both the student who copied work from another student and the student who gave material to be copied will receive a zero for the entire homework assignment, and failure of the course and University disciplinary action may be involved. Permissible collaboration should never involve one student having possession of another student's answers.

Midterms (50%) There will two in-class midterms.

Final Project (20%) Each student will be required to write a short paper. More details TBA.

Your final course score will be computed as a weighted average of your scores on the above components. A letter grade will be assigned based on your final score relative to the distribution of scores in the class. This approach allows me to assign letter grades without an absolute scale, and to adjust the percentages of the class receiving different letter grades (within limits). The percentage of students receiving any particular letter grade is not predetermined. It is possible for all students to get a C or above, and for the large majority to receive an A or a B. However, lower grades will be assigned to students who do not demonstrate proficiency or mastery of the material. Pluses and minuses will be used.

4 Student Accommodations

Students with a documented disability have the right to request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 512-471-6259 (voice) or 1-866-329-3986 (video phone). `http://ddce.utexas.edu/disability/about/`

- Please request a meeting as soon as possible to discuss any accommodations
- Please notify me as soon as possible if the material being presented in class is not accessible
- Please notify me if any of the physical space is difficult for you

5 Academic Integrity

The strength of the university depends on academic and personal integrity. Each student in the course is expected to abide by the University of Texas Honor Code:

> As a student of The University of Texas at Austin, I shall abide by the core values of the University and uphold academic integrity.

This means that work you produce on assignments, tests and exams is all your own work, unless it is assigned as group work. I will make it clear for each test, exam or assignment whether collaboration is encouraged or not.

Always cite your sources. If you use words or ideas that are not your own (or that you have used in previous class), you must make that clear otherwise you will be guilty of plagiarism and subject to academic disciplinary action, including failure of the course. You are responsible for understanding UT's Academic Honesty Policy which can be found at the following web address:

http://deanofstudents.utexas.edu/sjs/acint_student.php

5.1 Sharing of Course Materials is Prohibited

No materials used in this class, including, but not limited to, lecture hand-outs, videos, assessments (quizzes, exams, papers, projects, homework assignments), in-class materials, review sheets, and additional problem sets, may be shared online or with anyone outside of the class unless you have my explicit, written permission. Unauthorized sharing of materials promotes cheating. It is a violation of the University's Student Honor Code and an act of academic dishonesty.

I am well aware of the sites used for sharing course materials, and any materials found online that are associated with you, or any suspected unauthorized sharing of materials, will be reported to Student Conduct and Academic Integrity in the Office of the Dean of Students. These reports can result in sanctions, including failure in the course.

6 Textbooks

The course will mostly use academic papers and class notes. Here is a list of books that are highly recommended (but not required) to supplement assigned readings and/or your research:

- Introduction to Auctions
  - Hubbard, Tim and Harry Paarsch, *Auctions*, The MIT Press, 2015

    This book is a concise and comprehensive guide to the economic analysis of auctions, and I highly recommend it. It does not include a formal mathematical treatment of the different topics but it is a great source for the intuition behind each topic.
- Auction Theory
  - Krishna, Vijay. *Auction Theory*. 2nd ed. Burlington, MA: Academic Press/Elsevier, 2010.

    UT-Austin has rights to the online version:

    http://ebookcentral.proquest.com.ezproxy.lib.utexas.edu/lib/utxa/detail.action?docID=453046
  - Klemperer, Paul. *Auctions: Theory and Practice*. Princeton: Princeton University Press, 2004.

    It's free online:

    http://www.nuff.ox.ac.uk/users/klemperer/VirtualBook/VBCrevisedv2.asp

- ◇ Menezes, Flavio M., and Paulo K Monteiro. *An Introduction to Auction Theory*. Oxford: Oxford University Press, 2005.
- ◇ Milgrom, Paul R. *Putting Auction Theory to Work*. Cambridge, UK: Cambridge University Press, 2004.

  UT-Austin has rights to the online version:

  `http://ebookcentral.proquest.com.ezproxy.lib.utexas.edu/lib/utxa/detail.action?docID=255151`

- ◇ Empirical Analysis of Auction Data
  - ◇ Paarsch, Harry J., and Han Hong. *An Introduction to the Structural Econometrics of Auction Data*. The MIT Press, 2006.
  - ◇ Athey, Susan and Philip Haile (2007), Chapter 60 "Nonparametric Approaches to Auctions", *Handbook of Econometrics*, Volume 6, Part A, 2007, Pages 3847–3965.
- ◇ Game Theory
  - ◇ Steven Tadelis. *Game Theory: An Introduction*. Princeton: Princeton University Press, 2013.
  - ◇ Robert Gibbons. *Game Theory for Applied Economists*. Princeton: Princeton University Press, 1992.

7 Course Outline

This outline is tentative and, if time permits, we will be able to cover all topics in the order that follows.

Readings marked with an asterisk ($\star$) are required. (HP) refers to *Introduction to Auctions* by Hubbard and Paarsch, 2015. (K) refers to *Auction Theory* by Krishna, 2010. (T) refers to *Game Theory: An Introduction* by Tadelis, 2013.

1. Introduction

Readings: (HP) Chapter 1

(K) Chapter 1

Prendergast (2017), "How Food Banks Use Markets to Feed the Poor," *The Journal of Economic Perspectives*, Vol. 31, No. 4, pp. 145-161

McAfee and McMillan (1987), "Auctions and Bidding", *Journal of Economic Literature*

2. (An Introduction to) Game Theory

2.1 Games of Complete Information

Topics: Normal-form representation of games; Iterated elimination of strictly dominated strategies; Nash Equilibrium; Examples; Mixed strategies; Existence of Nash Equilibrium

Readings: (HP) Chapter 2

(T) Chapter 3, 4, 5, 6

($\star$) National Academy of Sciences (2003), "The Bidding Game"

($\star$) "Lance Armstrong and the Prisoners' Dilemma of Doping in Professional Sports", article on Wired by Bruce Schneier, 10/26/2012, `https://www.wired.com/2012/10/lance-armstrong-and-the-prisoners-dilemma-of-doping-in-professional-sports/`

($\star$) Walker and Wooders (2001), "Minimax Play at Wimbledon", *The American Economic Review*

2.2 Games of Incomplete Information

Topics: Normal-form representation of games of Bayesian games; Bayesian Nash Equilibrium; Examples

Readings: (HP) Chapter 2

(T) Chapter 12 & 13

3. Auction Theory and Applications

Readings: Klemperer (1999), "Auction Theory: A Guide to the Literature", *Journal of Economic Surveys*

3.1 Private Value Auctions

Topics: The private value model of auctions; Ascending auctions; First- and second-price sealed bid auctions; Dutch auctions; All-pay auctions

Readings: (HP) Chapter 3

(K) Chapter 2

3.1.1 The Revenue Equivalence Theorem

Readings: (HP) Chapter 3

(K) Chapter 3

3.1.2 Extensions

Topics: Asymmetries; Affiliation; Risk averse bidders

Readings: (HP) Chapter 4

(K) Chapter 4

Lebrun (1999), "First Price Auctions in the Asymmetric N Bidder Case", *International Economic Review*

Maskin and Riley (2000), "Asymmetric Auctions", *The Review of Economic Studies*

($\star$) Flambard and Perrigne (2006), "Asymmetry in Procurement Auctions: Evidence from Snow Removal Contracts", *The Economic Journal*

Li and Zhang (2015), "Affiliation and Entry in First-Price Auctions with Heterogeneous Bidders An Analysis of Merger Effects", *American Economic Journal: Microeconomics*

Maskin and Riley (1984), "Optimal Auctions with Risk Averse Buyers", *Econometrica*

Matthews (1987), "Comparing auctions for risk averse buyers a buyer's point of view", *Econometrica*

Lu and Perrigne (2008), "Estimating Risk Aversion from Ascending and Sealed-Bid Auctions The Case of Timber Auction Data", *Journal of Applied Econometrics*

3.2 Auction Design

Topics: Optimal reserve price; Encouraging participation; Bid preference programs

Readings: (HP) Chapter 4

(K) Chapter 2 & 4

($\star$) Klemperer (2002), "What Really Matters in Auction Design", *The Journal of Economic Perspectives*

Klemperer (2002), "How (not) to run auctions The European 3G telecom auctions", *European Economic Review*

Elyakime, Laffont, Loisel, and Vuong (1994), "First-Price Sealed-Bid Auctions with Secret Reservation Prices", *Annales d'Économie et de Statistique*

Li and Perrigne (2003), "Timber Sale Auction with Random Reserve Prices", *The Review of Economics and Statistics*

Hossain, Khalil, and Shum (2013), "Market Makers in Chittagong Tea Auctions The Role of Trust and Reputation", working paper

McAfee and McMillan (1987), "Auctions with Entry", *Economic Letters*

Levin and Smith (1994), "Equilibrium in Auctions with Entry", *The American Economic Review*

Samuelson (1985), "Competitive Bidding with Entry Costs", *Economic Letters*

Li and Zheng (2009), "Entry and Competition Effects in First-Price Auctions Theory and Evidence from Procurement Auctions", *The Review of Economic Studies*

McAfee and McMillan (1989), "Government Procurement and International Trade", *Journal of International Economics*

Krasnokutskaya and Seim (2011), "Bid Preference Programs and Participation in Highway Procurement Auctions", *The American Economic Review*

($\star$) Marion (2007), "Are bid preferences benign? The effect of small business subsidies in highway procurement auctions", *Journal of Public Economics*

3.3 Common Value Auctions

Topics: The common value model of auctions; The winner's curse; Examples and applications; When do prices aggregate information; Application to oil lease auctions

Readings: (HP) Chapter 4

(K) Chapters 6 & 7

($\star$) Capen, Clapp, and Campbell (1971), "Competitive Bidding in High-Risk Situations", *Journal of Petroleum Technology*

($\star$) Hendricks and Porter (1988), "An Empirical Study of an Auction with Asymmetric Information", *The American Economic Review*

Hendricks, Pinkse, and Porter (2003), "Empirical Implications of Equilibrium Bidding in First-Price, Symmetric, Common Value Auctions", *The Review of Economic Studies*

Hong and Shum (2002), "Increasing Competition and the Winner's Curse: Evidence from Procurement", *The Review of Economic Studies*

Wilson (1977) "A Bidding Model of Perfect Competition", *The Review of Economic Studies*

4. Empirical Analysis of Auction Data

Topics: Nonparametric density estimators; Structural estimation

Readings: Athey and Haile (2007), "Nonparametric Approaches to Auctions", *Handbook of Econometrics*, Volume 6, Part A, Chapter 60, Pages 3847–3965

Hickman, Hubbard, and Saglam (2012), "Structural Econometric Methods in Auctions: A Guide to the Literature", *Journal of Econometric Methods*

Guerre, Perrigne, and Vuong (2000), "Optimal Nonparametric Estimation of First-Price Auctions", *Econometrica*

Li, Perrigne, and Vuong (2002), "Structural Estimation of the Affiliated Private Value Auction Model", *The RAND Journal of Economics*

Campo, Perrigne, and Vuong (2003), "Asymmetry in First-Price Auctions with Affiliated Private Values", *The Journal of Applied Econometrics*

5. Other Topics

5.1 Collusion

Topics: Bid rigging and collusion; Theory and empirical applications

Readings: (HP) Chapter 5

(K) Chapter 11

Hendricks and Porter (1989), "Collusion in Auctions", *Annales d'Économie et de Statistique*

Marshall and Marx (2009), "The Vulnerability of Auctions to Bidder Collusion", *The Quarterly Journal of Economics*

Asker (2010), "A Study of the Internal Organization of a Bidding Cartel", *The American Economic Review*

($\star$) Porter and Zona (1999), "Ohio School Milk Markets An Analysis of Bidding", *The RAND Journal of Economics*

Pesendorfer (2000), "A Study of Collusion in First-Price Auctions", *The Review of Economic Studies*

5.2 Multi-Unit Auctions

Topics: Multi-Unit auctions; Uniform price auctions; Discriminatory price auctions; Demand reduction; Vickrey pricing; Sequential auctions; Examples and applications; Efficient auction design

Readings: (HP) Chapter 7

(K) Chapters 12 & 13

Wilson (1979), "Auctions of Shares", *The Quarterly Journal of Economics*

Armantier and Sbai (2006), "Estimation and Comparison of Treasury Auction Formats when Bidders Are Asymmetric", *The Journal of Applied Econometrics*

Hortacsu and Puller (2008), "Understanding strategic bidding in multi-unit auctions: a case study of the Texas electricity spot market", *The RAND Journal of Economics*

Hortacsu and McAdams (2010), "Mechanism Choice and Strategic Bidding in Divisible Good Auctions: An Empirical Analysis of the Turkish Treasury Auction Market", *Journal of Political Economy*

5.3 Internet Auctions

Topics: eBay Auctions; Sponsored Search Auctions; Google's advertising auction

Readings: (HP) Chapter 6 & 8

(K) Chapter 17

Roth and Ockenfels (2002), "Last-Minute Bidding and the Rules for Ending Second-Price Auctions: Evidence from eBay and Amazon Auctions on the Internet", *The American Economic Review*

($\star$) Bajari and Hortacsu (2004), "Economic Insights from Internet Auctions", *Journal of Economic Literature*

Bajari and Hortacsu (2003), "The Winner's Curse, Reserve Prices, and Endogenous Entry: Empirical Insights from eBay", *The RAND Journal of Economics*

Cabral and Hortacsu (2010), "The Dynamics of Seller Reputation: Evidence from eBay", *The Journal of Industrial Economics*

($\star$) *The Economist*, Aug 29th 2015, "Economists may idolise auctions, but most people do not"

Einav, Farronato, Levin, and Sundaresan (2013), "Sales Mechanisms in Online Markets: What Happened to Internet Auctions?", NBER Working Paper Series, No. 19021

($\star$) Varian (2007), "Position Auctions", *International Journal of Industrial Organization*

Edelman, Ostrovsky, and Schwarz (2007), "Internet Advertising and the Generalized Second-Price Auction: Selling Billions of Dollars Worth of Keywords", *The American Economic Review*