

# Economics of Auctions

## ECO 336M / 395K

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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, 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 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 market 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 2:00PM-3:30PM in PAR 203.
- ◇ Contact information
  - email            `jbalat@utexas.edu`
  - Office Hours    My regular office hours are on Wednesdays from 2 to 4 pm (CT) and they will take place via Zoom:  
`https://utexas.zoom.us/j/155701757`
- ◇ Teaching assistant: TBA
  - email            TBA
  - Office Hours    TBA
- ◇ It is your responsibility to check the course webpage on Canvas for announcements, assignments, and other material.
- ◇ Prerequisite: Economics 420K and 320L with a grade of at least C-.
- ◇ Any part of this syllabus is subject to change

## 3 Safety and Class Participation/Masks

*COVID Caveats: To help keep everyone at UT and in our community safe, it is critical that students report COVID-19 symptoms and testing, regardless of test results, to University Health Services, and faculty and staff report to the HealthPoint Occupational Health Program (OHP) as soon as possible. Please check <https://hr.utexas.edu/current/services/occupational-health-program> to understand what needs to be reported. In addition, to help understand what to do if a fellow student in the class (or the instructor or TA) tests positive for COVID, see this University Health Services link [https://healthyhorns.utexas.edu/coronavirus\\_exposure\\_action\\_chart.html](https://healthyhorns.utexas.edu/coronavirus_exposure_action_chart.html).*

We will all need to make some adjustments in order to benefit from in-person classroom interactions in a safe and healthy manner. Our best protections against spreading COVID-19 on campus are masks (defined as cloth face coverings) and staying home if you are showing symptoms. Therefore, for the benefit of everyone, this means that all students are required to follow these important rules:

- ◇ Every student must wear a cloth face-covering properly in class and in all campus buildings at all times.
- ◇ Students are encouraged to participate in documented daily symptom screening. This means that each class day in which on-campus activities occur, students must upload certification from the symptom tracking app and confirm that they completed their symptom screening for that day to Canvas. Students should

not upload the results of that screening, just the certificate that they completed it. If the symptom tracking app recommends that the student isolate rather than coming to class, then students must not return to class until cleared by a medical professional.

- ◇ Information regarding safety protocols with and without symptoms can be found here: [https://healthyhorns.utexas.edu/coronavirus\\_exposure\\_action\\_chart.html](https://healthyhorns.utexas.edu/coronavirus_exposure_action_chart.html)

If a student is not wearing a cloth face-covering properly in the classroom (or any UT building), that student must leave the classroom (and building). If the student refuses to wear a cloth face covering, class will be dismissed for the remainder of the period, and the student will be subject to disciplinary action as set forth in the university's Institutional Rules/General Conduct 11-404(a)(3). Students who have a condition that precludes the wearing of a cloth face covering must follow the procedures for obtaining an accommodation working with Services for Students with Disabilities.

## 4 Class Recordings

Class recordings are reserved only for students in this class for educational purposes and are protected under FERPA. The recordings should not be shared outside the class in any form. Violation of this restriction by a student could lead to Student Misconduct proceedings.

## 5 Requirements

*Class Participation and Readings (5%)* 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 will be short quizzes for some of the assigned readings.

*Problem Sets (20%)* There will be regular problem sets, assigned during the semester. The problem sets are designed to give the students an opportunity to review and enhance the material learned in class. Problem sets must be turned in at the beginning of class on the specified due dates. *Late submissions are not accepted.* Problem sets will be posted on the course web page. You are responsible for checking the website and downloading the questions.

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 (a copy of all or part of work done by someone else, in the form of an e-mail, a document attached to an email or on a flash drive or other storage device, or a hard copy, whether handwritten, photocopied, or printed).

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

*Final Project (25%)* Each student will be required to write a short paper. More details TBA.

Your weighted average course score will be computed from your scores on these components, and a grade will be assigned based on your 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.

## 6 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

## 7 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](http://deanofstudents.utexas.edu/sjs/acint_student.php)

### 7.1 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 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.

## 8 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

- ◇ (K) 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.

## 9 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 (★) are required.

### 1. Introduction

*Readings:* (K) Chapter 1

(★) National Academy of Sciences (2003), “The Bidding Game”.

(★) Prendergast (2015), “The Allocation of Food to Food Banks”, working paper

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

### 2. (A Very Quick Review of) Probability Theory

### 3. (An Introduction to) Game Theory

#### 3.1 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:* (★) Walker and Wooders (2001), “Minimax Play at Wimbledon”, *The American Economic Review*

#### 3.2 Games of Incomplete Information

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

### 4. Auction Theory and Applications

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

#### 4.1 Private Value Auctions

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

*Readings:* (K) Chapter 2

##### 4.1.1 The Revenue Equivalence Theorem

*Readings:* (K) Chapter 3

### 4.1.2 Extensions

*Topics:* Asymmetries; Affiliation; Risk averse bidders

*Readings:* (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*

(★) Flambar 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*

### 4.2 Auction Design

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

*Readings:* (★) 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*

(★) Marion (2007), “Are bid preferences benign? The effect of small business subsidies in highway procurement auctions”, *Journal of Public Economics*

### 4.3 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:* (K) Chapters 6 & 7

(★) Capen, Clapp, and Campbell (1971), “Competitive Bidding in High-Risk Situations”, *Journal of Petroleum Technology*

(★) 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*

## 5. 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*

## 6. Other Topics

### 6.1 Collusion

*Topics:* Bid rigging and collusion; Theory and empirical applications

*Readings:* (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*

(★) 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*

### 6.2 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:* (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*

### 6.3 Internet Auctions

*Topics:* eBay Auctions; Sponsored Search Auctions; Google’s advertising auction

*Readings:* 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*

(★) 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*

(★) *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

(★) 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*