

Fall 2003 (last revised 10/14/03)

<http://web.mit.edu/14.126/www/>

M 4-7; E51-372

## **ECONOMICS 14.126: Game Theory**

### General Information

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### Texts:

D. Fudenberg and J. Tirole (FT) *Game Theory (GT)*  
D. Fudenberg and D. Levine, *The Theory of Learning in Games (LG)*  
Osborne and Rubinstein, *A Course in Game Theory (OR)*, [Supplementary]  
Weibull, *Evolutionary Game Theory (W)*, [Supplementary]  
Krishna, *Auction Theory (K)*, [Supplementary]

This class presumes knowledge of game theory on the level of 14.121—14.124 or Economics 2010a (Harvard). The class does not have a final exam; instead the course grade will be based on assigned problem sets.

### Topics and Readings

The amount of time devoted to each topic is flexible and may be adjusted in response to student interests. The order of topics may change as well.

## 1. Repeated Games

### a) Imperfect Public Observations.

GT Section 5.5

Abreu, D., D. Pearce, and E. Stachetti [1990] "Towards a Theory of Discounted Repeated Games with Imperfect Monitoring," *Econometrica* 58, 1041-1064. [JSTOR: <http://links.jstor.org/sici?sici=0012-9682%28199009%2958%3A5%3C%3E1.0.CO%3B2-J>]

Athey, S., K. Bagwell [2001] "Optimal Collusion with Private Information," *RAND Journal of Economics*, Autumn 2001, 32(3), 428-465. <http://www.stanford.edu/~athey/ocpiwfig.pdf>

Athey, S., K. Bagwell, and C. Sanchirico [2003] "Collusion and Price Rigidity," *Review of Economic Studies*, forthcoming <http://www.stanford.edu/~athey/cpr.pdf>

Dellarocas, Chrysantos [2003] "Efficiency and Robustness of eBay-like Online Feedback Mechanisms in Environments with Moral Hazard," Working Paper <http://ccs.mit.edu/dell/SITE%202002.pdf>

Fudenberg, D., D. Levine, and E. Maskin [1994] "The Folk Theorem in Repeated Games with Imperfect Public Information," *Econometrica* 62, 997-1039. [JSTOR: <http://links.jstor.org/sici?sici=0012-9682%28199409%2962%3A5%3C997%3ATFTWIP%3E2.0.CO%3B2-8>]

Fudenberg, D. and D. Levine [1994] "Efficiency and Observability in Games with Long-Run and Short-Run Players," *Journal of Economic Theory* 62, 103-135. <http://dx.doi.org/10.1006/jeth.1994.1006>.

Green, E. and R. Porter [1984] "Non-Cooperative Collusion Under Imperfect Price Information," *Econometrica* 52, 87-100. [JSTOR: <http://links.jstor.org/sici?sici=0012-9682%28198401%2952%3A1%3C87%3ANCUIPI%3E2.0.CO%3B2-6>]

Kandori, M. [1992] "The Use of Information in Repeated Games with Imperfect Monitoring," *Review of Economic Studies*, 59, 581-594. [JSTOR: <http://links.jstor.org/sici?sici=0034-6527%28199207%2959%3A3%3C581%3ATUOIR%3E2.0.CO%3B2-5>]

Wiseman, T. [2003] "A Folk Theorem for Games With Unknown Payoff Distributions," Working Paper. <http://www.eco.utexas.edu/facstaff/Wiseman/upd.pdf>

### b) Imperfect Private Observations

Kandori, M. [2002] "Introduction to Repeated Games with Private Monitoring," *Journal of Economic Theory* 102(1), 1-15. [<http://dx.doi.org/10.1006/jeth.2001.2853>]

Kandori, M. and H. Matsushima [1998] "Private Observation, Communication, and Collusion," *Econometrica* 66, 627-652. [JSTOR: <http://links.jstor.org/sici?sici=0012-9682%28199805%2966%3A3%3C627%3APOCAC%3E2.0.CO%3B2-5>]

Mailath, G. and S. Morris [2002] "Repeated Games with Almost-Public Monitoring," *Journal of Economic Theory* 102(1), 189-228. [<http://dx.doi.org/10.1006/jeth.2001.2869>]

c) Community Enforcement

Dixit, A. [2003] "Trade Expansion and Contract Enforcement," Working Paper. [<http://www.princeton.edu/~dixitak/home/TradeExp.pdf>].

Ellison, G. [1993] "Cooperation in the Prisoner's Dilemma with Anonymous Random Matching," *Review of Economic Studies* 61, 567-588. [JSTOR: <http://links.jstor.org/sici?sici=0034-6527%28199407%2961%3A3%3C567%3ACITPDW%3E2.0.CO%3B2-L>]

Ghosh, P. and D. Ray [1996] "Cooperation in Community Interaction without Information Flows," *Review of Economic Studies* 63, 491-519. [JSTOR: <http://links.jstor.org/sici?sici=0034-6527%28199607%2963%3A3%3C491%3ACICIWI%3E2.0.CO%3B2-Z>]

Kandori, M. [1992] "Social Norms and Community Enforcement," *Review of Economic Studies* 59 63-80. [JSTOR: <http://links.jstor.org/sici?sici=0034-6527%28199201%2959%3A1%3C63%3ASNACE%3E2.0.CO%3B2-W>]

Mobius, M. [2001] "Trading Favors" [<http://post.economics.harvard.edu/faculty/mobius/favors.pdf>]

d) Repeated Extensive-Form Games

Rubinstein, A. and A. Wolinsky [1995] "Remarks on Infinitely Repeated Extensive-Form Games," *Games and Economic Behavior* 9, 110-115. [<http://dx.doi.org/10.1006/game.1995.1007>]

Sorin, S. [1995] "A Note on Repeated Extensive Games," *Games and Economic Behavior* 9, 116-123. [<http://dx.doi.org/10.1006/game.1995.1008>]

Takahashi, S. [2002] "Effective Minimax Values in Extensive Form Games with Almost Perfect Information"

[http://www.courses.fas.harvard.edu/~ec2052/Papers\\_Not\\_Available\\_Elsewhere/](http://www.courses.fas.harvard.edu/~ec2052/Papers_Not_Available_Elsewhere/)

Wen, Q. (2002a), "Folk Theorem for Repeated Sequential Games" *Review of Economic Studies* 69, 493-512

## 2. Reputation Effects and Repeated Signaling

GT Ch. 9

Celentani, M., D. Fudenberg, D. Levine, and W. Pesendorfer [1996] "Maintaining a Reputation Against a Long-Lived Opponent," *Econometrica* 64, 691-704. [JSTOR: <http://links.jstor.org/sici?sici=0012-9682%28199605%2964%3A3%3C691%3AMARAAL%3E2.0.CO%3B2-M>]

Celentani, M. and W. Pesendorfer [1996] "Reputation in Dynamic Games," *Journal of Economic Theory* 70(1), 109-132. <http://dx.doi.org/10.1006/jeth.1996.0078>.

Ely, J. and J. Välimäki [2001] "Bad Reputation" *Quarterly Journal of Economics*, forthcoming.  
<http://www.kellogg.nwu.edu/research/math/JeffEly/working/badrep6.pdf>

Ely, J., D. Fudenberg, and D. Levine [2002] "When is Reputation Bad,"  
<http://fudenberg.fas.harvard.edu/mypapers.htm>.

Fudenberg, D. and D. Levine [1992] "Maintaining a Reputation When Strategies Are Imperfectly Observed," *Review of Economic Studies* 59, 561-581. [JSTOR: <http://links.jstor.org/sici?sici=0034-6527%28199207%2959%3A3%3C561%3AMARWSA%3E2.0.CO%3B2-0>]

Mailath, G. and L. Samuelson [1997] "Your Reputation is Who You're Not and Not Who You Would Like to Be," CARESS Working Paper 98-11.  
<http://www.ssc.upenn.edu/~gmailath/wpapers/wpapers.html>

Mailath, G., M. Cripps and L. Samuelson [2002] "Imperfect Monitoring and Impermanent Reputations," Working Paper.  
<http://www.ssc.upenn.edu/~gmailath/wpapers/wpapers.html>

Schmidt, K., [1993] "Reputation and Equilibrium Selection in Repeated Games of Conflicting Interests," *Econometrica* 61, 325-351. [JSTOR: <http://links.jstor.org/sici?sici=0012-9682%28199303%2961%3A2%3C325%3ARAECIR%3E2.0.CO%3B2-0>]

Sorin, S. [1999] "Merging, Reputation, and Repeated Games with Incomplete Information," *Games and Economic Behavior* 29, 274-308.  
<http://dx.doi.org/10.1006/game.1999.0722>

Tirole, J., 1996, "A Theory of Collective Reputations (with applications to the persistence of corruption and to firm quality)," *Review of Economic Studies* 63, 1-22. [JSTOR: <http://links.jstor.org/sici?sici=0034-6527%28199601%2963%3A1%3C1%3AATOCR%28%3E2.0.CO%3B2-C>]

### 3. Knowledge, Common Knowledge, Almost Common Knowledge, and Rational Play

#### a) Knowledge and Common Knowledge

GT Ch. 14

Aumann, R. [1976] "Agreeing to Disagree," *Annals of Statistics* 4, 1236-1239. [JSTOR: <http://links.jstor.org/sici?sici=0090-5364%28197611%294%3A6%3C1236%3AATD%3E2.0.CO%3B2-D>]

Dekel, E., B. Lipman, and A. Rustichini [1998] "Standard State-Space Models Preclude Unawareness," *Econometrica* 66, 159-174. [JSTOR: Stable URL: <http://links.jstor.org/sici?sici=0012-9682%28199801%2966%3A1%3C159%3ASSMPU%3E2.0.CO%3B2-K>]

Monderer, D. and D. Samet [1989] "Approximating Common Knowledge with Common Beliefs," *Games and Economic Behavior* 1, 170-190.

Samet, D. [1998] "Iterated Expectations and Common Priors," *Games and Economic Behavior* 24, 131-141. [<http://dx.doi.org/10.1006/game.1997.0616>]

#### b) Knowledge about Opponents' Play

GT Ch. 2

Ambrus, A. [2001] "Coalitional Rationality"  
<http://www.princeton.edu/~aambrus>.

Brandenburger, A., and E. Dekel [1987] "Rationalizability and Correlated Equilibrium," *Econometrica* 55, 1391-1402. [JSTOR: <http://links.jstor.org/sici?sici=0012-9682%28198711%2955%3A6%3C1391%3ARACE%3E2.0.CO%3B2-A>]

Brandenburger, A., and A. Friedenberg [2002] "Common Assumption of Rationality in Games," Working Paper

Dekel, E., D. Fudenberg, and D. Levine [1999] "Payoff Information and Self-Confirming Equilibrium," Working Paper  
<http://levine.sscnet.ucla.edu/Papers/ack32rc.pdf>

Dekel, E. and F. Gul [1997] "Rationality and Knowledge in Game Theory, in *Advances in Economics and Econometrics: Theory and Applications*, D. M. Kreps and K. F. Wallis (eds.), Cambridge University Press, 1997.

<http://www.courses.fas.harvard.edu/~ec2052/Papers Not Available Elsewhere/>

Pearce, D. [1984] "Rationalizable Strategic Behavior and the Problem of Perfection," *Econometrica* 52, 1029-1050. [JSTOR: <http://links.jstor.org/sici?sici=0012-9682%28198407%2952%3A4%3C1029%3ARSBATP%3E2.0.CO%3B2-7>]

Rubinstein, A. and A. Wolinsky [1994] "Rationalizable Conjectural Equilibrium," *Games and Economic Behavior* 6, 299-311. <http://dx.doi.org/10.1006/game.1994.1016>.

#### c) Knowledge and Types in Bayesian Games

Brandenburger, A. and E. Dekel [1993] "Hierarchies of Beliefs and Common Knowledge," *Journal of Economic Theory* 59, 189-198.

<http://dx.doi.org/10.1006/jeth.1993.1012>

Lipman, B [2002] "Finite Order Implications of Common Priors," Working Paper

<http://www.ssc.wisc.edu/~b lipman/Papers/note2.pdf>

Morris, S. [2002] "Typical Types," Working Paper.

<http://www.courses.fas.harvard.edu/~ec2052/Papers Not Available Elsewhere/>

Morris, S., R. Rob, and H. Shin [1993] "p-Dominance and Belief Potential,"

*Econometrica* 63, 145-58. [JSTOR: <http://links.jstor.org/sici?sici=0012-9682%28199501%2963%3A1%3C145%3AABP%3E2.0.CO%3B2-0>]

Morris, S. and H. Shin [1999] "Private versus Public Information in Coordination Problems"

<http://www.econ.yale.edu/~sm326/research.html>.

## 4. Learning in Strategic-Form Games

LG Ch. 2 and 4

Benaim, M. [1996] "A Dynamical System Approach to Stochastic Approximations," *Siam J. Control and Optimization* 34, 437-472.

Benaim, M. and M. Hirsch [1999] "Mixed Equilibria Arising from Fictitious Play in Perturbed Games," *Games and Economic Behavior* 29, 36-72.

<http://dx.doi.org/10.1006/game.1999.0717>

Börger, T., A. Morales, and R. Sarin [2001] "Expedient and Monotone Learning Rules"

<http://www.ucl.ac.uk/~uctpa01/Papers.htm>.

- Erev, I. And A. Roth [1998] "Predicting how people play games: Reinforcement learning in experimental games with unique, mixed strategy equilibria," *American Economic Review* 88, 848-881. [<http://links.jstor.org/sici?sici=0002-8282%28199809%2988%3A4%3C848%3APHPPGR%3E2.0.CO%3B2-R>]
- Foster, D., and R. Vohra [1998] "Asymptotic Calibration," *Biometrika* 85, 379-390. [Available as postscript at <http://gosset.wharton.upenn.edu/~foster/research/calibration.ps>]
- Fudenberg, D. and D. Kreps [1993] "Learning Mixed Equilibria," *Games and Economic Behavior* 5, 320-367. <http://dx.doi.org/10.1006/game.1993.1021>
- Hart, S. and A. Mas-Colell [2001] "A Simple Adaptive Procedure Leading to Correlated Equilibrium," *Econometrica* 68, 1127-1150. <http://www.ma.huji.ac.il/~hart/abs/adapt.html>.
- Hart, S. and A. Mas-Colell [2001] "A General Class of Adaptive Strategies," *Journal of Economic Theory* 98, 26-54 <http://www.ma.huji.ac.il/~hart/abs/genadapt.html> or <http://dx.doi.org/10.1006/jeth.2000.2746>.
- Hofbauer, J. and W. Sandholm [2001] "Evolution and Learning in Games with Randomly Disturbed Payoffs" <http://www.wu-wien.ac.at/inst/vw1/gee/emaee/Hofbauer.pdf>
- Hopkins, E. [1999] "A Note on Best Response Dynamics," *Games and Economic Behavior* 29, 138-150. [<http://dx.doi.org/10.1006/game.1997.0636>]
- Hopkins, E. [2000] "Two Competing Models of How People Learn in Games" <http://www.ed.ac.uk/econ/pdf/twocom.pdf>
- Sandholm, W. [2002] "Negative Externalities and Evolutionary Implementation," Working Paper. [http://www.courses.fas.harvard.edu/~ec2052/Papers\\_Not\\_Available\\_Elsewhere/](http://www.courses.fas.harvard.edu/~ec2052/Papers_Not_Available_Elsewhere/)

## 5. Myopic Adjustment with Persistent Randomness

LG Ch. 5

- Benaim, M. and J. Weibull [2000] "Deterministic Approximation of Stochastic Evolution in Games," mimeo. <http://www.iui.se/wp/wp534/iuiwp534.pdf>
- Ellison, G. [2000] "Basins of Attraction, Long Run Equilibria, and the Speed of Step-by-Step Evolution," *Review of Economic Studies* 67, 17-45. <http://web.mit.edu/gellison/www/basins.pdf>.

- Ely, J. [1996] "Local Conventions," mimeo, Northwestern University.  
[http://www.courses.fas.harvard.edu/~ec2052/Papers\\_Not\\_Available\\_Elsewhere/](http://www.courses.fas.harvard.edu/~ec2052/Papers_Not_Available_Elsewhere/)
- Goyal, S. and F. Vega-Redondo [2000] "Learning, Network Formation and Coordination," mimeo.  
<http://www.eur.nl/WebDOC/doc/econometrie/feweco19991222152915.pdf>.
- Hojman, D., and A. Szeidl "Endogenous Networks, Social Games, and Evolution"  
 Working Paper  
[http://www.courses.fas.harvard.edu/~ec2052/Papers\\_Not\\_Available\\_Elsewhere/](http://www.courses.fas.harvard.edu/~ec2052/Papers_Not_Available_Elsewhere/)
- Kandori, M., G. Mailath, G. and R. Rob [1992] "Learning, Mutation, and Long Run Equilibria in Games," *Econometrica* 61, 29-56. [JSTOR:  
<http://links.jstor.org/sici?sici=0012-9682%28199301%2961%3A1%3C29%3ALMALRE%3E2.0.CO%3B2-F>]
- Levine, D.K. and W. Pesendorfer [2002] "Evolution of Cooperation Through Imitation"  
<http://www.dklevine.com/papers/evoshort15.pdf>
- Mobius, M. [2000] "The Formation of Ghettos as a Local Interaction Phenomenon," mimeo, Harvard University.  
[http://www.courses.fas.harvard.edu/~ec2052/Papers\\_Not\\_Available\\_Elsewhere/](http://www.courses.fas.harvard.edu/~ec2052/Papers_Not_Available_Elsewhere/)

## 6. Learning in Extensive-Form Games

LG ch. 6

- Fudenberg, D. and D. Levine [1993] "Self-Confirming Equilibrium," *Econometrica* 61, 523-546. [JSTOR: <http://links.jstor.org/sici?sici=0012-9682%28199305%2961%3A3%3C523%3ASE%3E2.0.CO%3B2-I>]
- Fudenberg, D. and D. Levine [1993] "Steady State Learning and Nash Equilibrium," *Econometrica* 61, 547-573. [JSTOR: <http://links.jstor.org/sici?sici=0012-9682%28199305%2961%3A3%3C547%3ASSLANE%3E2.0.CO%3B2-Z>]
- Fudenberg, D. and D. Kreps [1995] "Learning in Extensive Games, I: Self-Confirming Equilibria," *Games and Economic Behavior* 8, 20-55.
- Jehiel, P. and D. Samet [2001] "Learning to Play Games in Extensive Form by Valuation" Working Paper  
[http://www.courses.fas.harvard.edu/~ec2052/Papers\\_Not\\_Available\\_Elsewhere/](http://www.courses.fas.harvard.edu/~ec2052/Papers_Not_Available_Elsewhere/)
- Noldeke, G. and L. Samuelson [1993] "An Evolutionary Analysis of Forward and Backward Induction," *Games and Economic Behavior* 5, 425-454.  
<http://dx.doi.org/10.1006/game.1993.1024>

## 7. Auctions and Mechanism Design

K, Chaps. 2,3,5-7,10,17.  
GT, Ch. 7

### (a) General Auction Theory

Vickrey, W. (1961), "Counterspeculation, Auctions, and Competitive Sealed Tenders," *Journal of Finance* 16, 8-37. <http://links.jstor.org/sici?sici=0022-1082%28196103%2916%3A1%3C8%3ACAAACST%3E2.0.CO%3B2-L>

Milgrom, P. and R. Weber (1982), "A Theory of Auctions and Competitive Bidding," *Econometrica* 50, 1089-1122. [JSTOR: <http://links.jstor.org/sici?sici=0012-9682%28198209%2950%3A5%3C1089%3AATOAAC%3E2.0.CO%3B2-E>]

Milgrom, P. and R. Weber (2000), "A Theory of Auctions and Competitive Bidding, II" in P. Klemperer (ed.), *The Economic Theory of Auctions*, Cheltenham, U.K.: Edward Elgar.

Maskin, E. (1992), "Auctions and Privatization," in *Privatization* (ed. by H. Siebert), Institut für Weltwirtschaft an der Universität Kiel.

Che, Y-K. and I. Gale (1998): "Standard Auctions with Financially Constrained Bidders," *REStud*, 65, 1-22. <http://links.jstor.org/sici?sici=0034-6527%28199801%2965%3A1%3C1%3ASAWFCB%3E2.0.CO%3B2-5>

Klemperer, P. (2003): "Why Every Economist Should Learn Some Auction Theory," in M. Dewatripont, L. Hansen, and S. Turnovsky (eds.), *Advances in Economics and Econometrics*, Cambridge, U.K.: Cambridge Univ. Press.

Krishna, V. (2003): "Asymmetric English Auctions," forthcoming in JET. <http://econ.la.psu.edu/~vkrishna/papers/eng19.pdf>

### (b) Optimal mechanisms.

Myerson, R. (1981), "Optimal Auction Design," *Mathematics of Operations Research* 6, pp. 58-73.

Bulow, J. and J. Roberts (1989), "The Simple Economics of Optimal Auctions," *JPE*, 97, 1060-90. <http://links.jstor.org/sici?sici=0022-3808%28198910%2997%3A5%3C1060%3ATSEOOA%3E2.0.CO%3B2-8>

Armstrong, M. (2000), "Optimal Multi-Object Auctions," *REStud*, 67, 455-481.

- Cremer, J. and R. McLean (1985), "Optimal Selling Strategies under Uncertainty for a Discriminating Monopolist when Demands are Interdependent," *Econometrica*, 53, 345-361. <http://links.jstor.org/sici?sici=0012-9682%28198503%2953%3A2%3C345%3AOSSUUF%3E2.0.CO%3B2-6>.
- Cremer, J. and R. McLean (1988), "Full Extraction of the Surplus in Bayesian and Dominant Strategy Auctions," *Econometrica*, 56, 1247-1257. <http://links.jstor.org/sici?sici=0012-9682%28198811%2956%3A6%3C1247%3AFEOTSI%3E2.0.CO%3B2-P>.
- d'Aspremont, G. and L.A. Gerard-Varet (1979) "Incentives and Incomplete Information," *Journal of Public Economics*, 11, 25-45.
- McAfee, P. and P. Reny, "Correlated Information and Mechanism Design," *Econometrica*, 60, 395-421. <http://links.jstor.org/sici?sici=0012-9682%28199203%2960%3A2%3C395%3ACIAMD%3E2.0.CO%3B2-4>.
- Zheng, C. (2002), "[Optimal Auctions with Resale](#)," *Econometrica*, v70, n6, 2197-2224 (November 2002).
- (c) Efficient mechanisms, information aggregation.
- Maskin, E. (2003): "Auctions and Efficiency," in M. Dewatripont, L. Hansen, and S. Turnovsky (eds.), *Advances in Economics and Econometrics*, Cambridge, U.K.: Cambridge Univ. Press.
- Holmstrom, B. and R. Myerson (1983): "Efficient and Durable Decision Rules with Incomplete Information," *Econometrica*, 51, 1799-1820. <http://links.jstor.org/sici?sici=0012-9682%28198311%2951%3A6%3C1799%3AEADDRW%3E2.0.CO%3B2-H>.
- Myerson, R. and M. Satterthwaite (1983): "Efficient Mechanisms for Bilateral Trading," *JET*, 28, 265-281.
- Dasgupta, P., and E. Maskin (2000), "Efficient Auctions," *Quarterly Journal of Economics*, 115, 341-388.
- Krishna, V. and M. Perry (1998): "Efficient Mechanism Design," mimeo, <http://www.ma.huji.ac.il/~motty/papers/vcg19.pdf>.
- Jehiel, P. and Moldovanu, B. (2001), "Efficient Design with Interdependent Valuations," *Econometrica*, 69, 1237-1259. (mimeo version: <http://else.econ.ucl.ac.uk/papers/jehiel/fineff.pdf>).

Ausubel, L. (1997), "An Efficient Ascending-Bid Auction for Multiple Objects," mimeo, University of Maryland: <http://www.ausubel.com/auction-papers/efficient-ascending-auction-r.pdf>.

Ausubel, L. (1999), "A Generalized Vickrey Auction," mimeo, University of Maryland: <http://www.ausubel.com/auction-papers/99wp-generalized-vickrey.pdf>

Pesendorfer, W. and J. Swinkels (2000), "Efficiency and Information Aggregation in Auctions," *American Economic Review*, 90, 499-525.

Izmalkov, S (2003), "Multi-Unit Efficient Open Ascending Price Auction", working paper: [http://econ-www.mit.edu/faculty/download\\_pdf.php?id=467](http://econ-www.mit.edu/faculty/download_pdf.php?id=467).

(d) Auction design

Avery, C. (1998): "Strategic Jump Bidding in English Auctions," *REStud*, 65, 185-210. <http://links.jstor.org/sici?sici=0034-6527%28199804%2965%3A2%3C185%3ASJBIEA%3E2.0.CO%3B2-Q>

Bulow, J. and P. Klemperer (1996), "Auctions versus Negotiations," *AER*, 86, 180-194. <http://links.jstor.org/sici?sici=0002-8282%28199603%2986%3A1%3C180%3AAVN%3E2.0.CO%3B2-%23>

Perry, M. and P. Reny (2002), "An Efficient Auction," *Econometrica*, 70, 1199-1212. (mimeo version: <http://www.src.uchicago.edu/users/preny/efficient-auction.pdf>).

Perry, M. and P. Reny (2001), "An Efficient Multi-Unit Ascending Auction," Univ. of Chicago, mimeo. <http://www.src.uchicago.edu/users/preny/ascending-auction.pdf>.

Izmalkov, S. (2003), "English Auctions with Reentry", working paper: [http://econ-www.mit.edu/faculty/download\\_pdf.php?id=465](http://econ-www.mit.edu/faculty/download_pdf.php?id=465).

Bergemann, D. and S. Morris, "Robust Mechanism Design," Yale University, working paper, [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=412497](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=412497)

(e) Existence

Athey, S. (2001), "Single Crossing Properties and the Existence of Pure Strategy Equilibria in Games of Incomplete Information," *Econometrica*, 69, 861-889. (mimeo version: <http://www.stanford.edu/~athey/scpexist.pdf>).

Maskin, E and J. Riley: "Equilibrium in Sealed High Bid Auctions," *REStud*, 67, 413-438. <http://www.econ.ucla.edu/riley/research/equilRES.PDF>.

Perry, M. and P. Reny (2002), "Toward a Strategic Foundation for Rational Expectations Equilibrium," Working Paper

<http://www.src.uchicago.edu/users/preny/research.htm>

Lebrun, B (1996): "Existence of an Equilibrium in First Price Auctions," *Economic Theory*, 7, 421-443.

Jackson. M. and J. Swinkels (2001): "Existence of Equilibrium in Single and Double Private Value Auctions," mimeo: <http://www.hss.caltech.edu/~jacksonm/mjjs.pdf>

(f) Collusive behavior

Athey, S., K. Bagwell [2001] "Optimal Collusion with Private Information," *RAND Journal of Economics*, Autumn 2001, 32(3), 428-465.  
<http://www.stanford.edu/~athey/ocpiwfig.pdf>

Athey, S., K. Bagwell, and C. Sanchirico [2003] "Collusion and Price Rigidity," *Review of Economic Studies*, forthcoming  
<http://www.stanford.edu/~athey/cpr.pdf>

Graham, D. and R. Marshall (1987): "Collusive Behaviour at Single-Object Second-Price and English Auctions," *JPE*, 95, 1217-1239. <http://links.jstor.org/sici?sici=0022-3808%28198712%2995%3A6%3C1217%3ACBBASS%3E2.0.CO%3B2-Z>

Hendrics, K. and R. Porter (1989): "Collusion in Auctions," *Annales d'Economie et de Statistique*, 15/16, 217-230.

McAfee, P. and J. McMillan (1992), "Bidding Rings," *AER*, 82, 579-599.  
<http://links.jstor.org/sici?sici=0002-8282%28199206%2982%3A3%3C579%3ABR%3E2.0.CO%3B2-D>

Marx, L. and R.C. Marshall (2003), "Bidder Collusion," working paper:  
<http://faculty.fuqua.duke.edu/~marx/bio/papers/biddercollusion.pdf>

## 8. Supermodular Games

Topkis, D. M. (1998) *Supermodularity and Complementarity*, Princeton.

Tarski, A. (1955) "A Lattice-Theoretical Fixpoint Theorem and its Applications," *Pacific Journal of Mathematics*, 5, 285-309.

Topkis, D. M. (1979) "Equilibrium Points in Nonzero-sum n-person Submodular Games," *SIAM Journal of Control and Optimization*, 17, 773-787.

Milgrom, P. and J. Roberts (1990) "Rationalizability and Learning in Games with Strategic Complementarities," *Econometrica*, 58, 1255-1277.

- <http://links.jstor.org/sici?sici=0012-9682%28199011%2958%3A6%3C1255%3ARLAEIG%3E2.0.CO%3B2-S>.
- Vives, X. (1990) "Nash Equilibrium with Strategic Complementarities," *Journal of Mathematical Economics*, 19, 305-321.
- Milgrom, P. and J. Roberts (1991) "Adaptive and Sophisticated Learning in Normal Form Games," *Games and Economic Behavior*, 3, 82-100.
- Milgrom, P. and C. Shannon (1994) "Monotone Comparative Statics," *Econometrica*, 62, 157-180. <http://links.jstor.org/sici?sici=0012-9682%28199401%2962%3A1%3C157%3AMCS%3E2.0.CO%3B2-P>.
- Zhou, L. (1994) "The Set of Nash Equilibria of a Supermodular Game is a Complete Lattice," *Games and Economic Behavior*, 7, 295-300.  
<http://dx.doi.org/10.1006/game.1994.1051>
- Topkis, D. (1995) "Comparative Statics of the Firm," *Journal of Economic Theory*, 67, 370-401. <http://dx.doi.org/10.1006/jeth.1995.1078>.
- Athey, S. (1997) "Comparative Statics under Uncertainty: Single Crossing Properties and Log-Supermodularity," mimeo. <http://www.stanford.edu/~athey/CSU0900.pdf> or <http://www.stanford.edu/~athey/CSU0498.pdf>.