ADVANCED MICROECONOMICS I
Universidad Carlos III-Fall 2007
Professor: Antonio Cabrales

Evolutionary games and applications to mechanism design

This part of the course is intended as a brief introduction to evolutionary game theory and an overlook on some applications to implementation theory on which I have been working on and off for some time.

Since there are quite a few books dealing with learning and evolution in games, let me just list a few textbooks. You will find tons of references therein.

- D. Fudenberg and D. Levine (1998), *Theory of Learning in Games*, Cambridge MA: MIT Press.
- J. Hofbauer, K. Sigmund (1988), *Dynamical Systems and the Theory of*
- *Evolution*, Cambridge: Cambridge University Press.
- J. Maynard Smith (1982), *Evolution and the Theory of Games*, Cambridge:
- Cambridge University Press.
- L. Samuelson (1997), *Evolutionary Games and Equilibrium Selection*, Cambridge MA: MIT Press.
- E. Van Damme (1987), *Stability and Perfection of Nash Equilibria*, Berlin: Springer Verlag.
- F. Vega Redondo (1996), *Evolution, Games and Economic Behavior*, Oxford:
- Oxford University Press.
- F. Vega Redondo (2003), *Economics and the Theory of Games*, Cambridge:
- Cambridge University Press.
- J.W. Weibull (1995), *Evolutionary Game Theory*, Cambridge MA: MIT
- Press.
- H.P. Young (1998), *Individual Strategy and Social Structure*, Princeton:
- Princeton University Press.
- H.P. Young (2004), *Strategic Learning and Its Limits*, Oxford: Oxford
- University Press.

The papers of mine that I will talk about are:

- Antonio Cabrales and Roberto Serrano (2007), Implementation in Adaptive Better-Response Dynamics, mimeo.
- Antonio Cabrales and Giovanni Ponti (2000), *Implementation, Elimination of Weakly Dominated Strategies and Evolutionary Dynamics*. **Review of Economic Dynamics**, *3*:247-282.
- Antonio Cabrales (1999), *Adaptive Dynamics and the Implementation Problem with Complete Information*. **Journal of Economic Theory**, *86*:159-184.

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Game theory and Networks

Networks pervade socio-economic life. They also pervade our discipline. The work in the area has connections with many different sub-fields of game theory, from cooperative games, to refinements, evolutionary games, bargaining and other interesting topics. At the same time there are numerous applications in different fields. Just to name a few: industrial organization, labor economics, organization theory and information theory. So I expect this course to be of interest to people coming from many different backgrounds.

Rather than being exhaustive, we will try to cover a few papers in depth, and hope that you get interested and do more exploration on your own. The reading list contains a sample of papers that I find interesting. The double starred readings are the ones we will cover (time permitting) in class. The starred readings are papers I expect you to read, in addition to those covered in class. Consider them the *homework*. The *exam* will contain a few exercises that will be radically simplified versions of models in starred readings.

<u>Network formation: stability and efficiency.</u>

- * * M. Jackson and A. Wolinsky (1996), "A Strategic Model of Economic and Social Networks," *Journal of Economic Theory*, 71:44-74.
- B. Dutta and S. Mutuswami (1997), "Stable Networks," *Journal of Economic Theory*, 76:322-344.
- * V. Bala and S. Goyal (2000), "A Non-Cooperative Model of Network Formation," *Econometrica*, 68:1181-1231.

<u>Games played on fixed networks.</u>

- ** S. Morris (2000), "Contagion," *Review of Economic Studies*, 67:57-78.
- ** M. Chwe (2000), "Communication and Coordination in Social Networks," *Review of Economic Studies*, 67:1-16.
- ** Y. Bramoullé and R. Kranton (2007), "Public Goods in Networks" , *Journal of Economic Theory* , 135:478-494.
- ** C. Ballester, A. Calvó-Armengol and Y. Zenou (2006), "Who's Who in Networks. Wanted: The Key Player," *Econometrica* 75:1403-1418.
- ** Antonio Cabrales, Antoni Calvó-Armengol and Yves Zenou (2006), *Efforts and Synergies in Network Formation.*
- ** Andrea Galeotti and Sanjeev Goyal (2007), *The Law of the Few.*

<u>Learning and Evolution in Networks.</u>

- V. Bala and S. Goyal (1997), "Learning from Neighbours," *Review of Economic Studies*, 65:595-621.
- M. Jackson and A. Watts (2002), "The Evolution of Social and Economic Networks," *Journal of Economic Theory*, 106:265–295.
- * S. Goyal and F. Vega-Redondo (2005), "Learning, Network Formation and Coordination," *Games and Economic Behavior*, 50:178-207.

Networks and foundation of solution concepts in coalitional games.

- R. B. Myerson (1977), "Graphs and Cooperation in Games," *Mathematics of Operations Research*, 2:225-229.
- R. B. Myerson (1981), "Conference Structures and Fair Allocation Rules," *International Journal of Game Theory*, 9:170-182.
- *A. Kirman, C. Oddou and S. Weber (1986), "Stochastic Communication and Coalition Formation," *Econometrica*, 54:129-138.

The statistical mechanics approach to networks (a little physics).

- D.J. Watts (1999), *Small Worlds*, Princeton NJ: Princeton University Press.
- M.E.J. Newman, C. Moore and D.J. Watts (2000), "Mean-Field Solution of the Small World Network Model," *Physical Review Letters* 84:3201-3204.
- * R. Albert and A.-L. Barabási (2002), "Statistical Mechanics of Complex Networks," Review of Modern Physics, 74, 47.

Applications 1 – Industrial organization.

- K. Hendricks, M. Piccione and G. Tan (1999), "Competition in airline networks," *Econometrica* 67:1407-1434.
- R.E. Kranton and D. F. Minehart (2000), "Networks versus Vertical Integration," *Rand Journal of Economics* 31:570-601.
- * R.E. Kranton and D. F. Minehart (2001), "A Theory of Buyer-Seller Networks," *American Economic Review*, 91:485-508.

Applications 2 – Labor and bargaining.

- J. Montgomery (1991), "Social networks and labor market outcomes: toward and economic analysis," *American Economic Review* 81:1408–1418.
- * M. Corominas (2004), "Bargaining in a Network of Buyers and Sellers," *Journal of Economic Theory* 115:35-77.
- A. Calvó-Armengol (2004), "Job Contact Networks," *Journal of Economic Theory* 115:191-206.
- *A. Calvó-Armengol and M.O. Jackson (2004), "The Effects of Social Networks on Employment and Inequality," *American Economic Review* 94: 426-454.

Applications 3 – Organization and information theory.

- R. Radner (1993), "The Organization of Decentralized Information Processing," *Econometrica* 61:1109-1146.
- P. Bolton and M. Dewatripont (1994), "The Firm as a Communication Network," *Quarterly Journal of Economics* 109:809-839.
- * L. Garicano (2000), "Hierarchies and the Organization of Knowledge in Production," *Journal of Political Economy* 108:874-904.
- * Roger Guimerà, Albert Díaz-Guilera, Fernando Vega-Redondo, Antonio Cabrales and Àlex Arenas (2002), "Optimal network topologies for local search with congestion," *Physical Review Letters*, *89*:248701.