Complex Social Networks

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Syllabus

The course will be divided into two parts. The first part will be devoted to the very basic theory of complex networks (using the tools of complex-system analysis), followed by a discussion of some paradigmatic models of network formation (using the classical game theory methodology). This material will be presented by me in class, on the basis of some available lecture notes. The second part will focus on specific topics and will be based on a detailed presentation of some recent papers. These papers will be presented by students in class and will be amply discussed thereafter by all participants in the course. As you will see, these topics are largely selected following my own research interests in the field and many of the papers are very recent.

Part I: Complex networks: basic theory

1. **Networks: introduction**
   1.1. Complex networks in the real world: examples and empirical regularities
   1.2. Formalization, local and global network measures

2. **Complex networks**
   2.1. Random networks
       2.1.1. Poisson networks
       2.1.2. Generalized random networks

   2.2. Structured networks
       2.2.1. Small worlds
       2.2.2. Scale-free networks

3. **Epidemics in complex networks**
   3.1. The SI model: the size of epidemic waves
   3.2. The SIS model: the prevalence of infection

4. **Network formation**
   4.1. Game theoretic approach: some paradigmatic models
   4.2. Volatility
       4.2.1. Network formation and local search
       4.2.2. Network formation and coordination

Part II: Specific topics

I list six topics and two or three papers per topic. These papers are intended to present contrasting approaches to the same problem. Part of the task in the presentation and paper will be to elaborate on this contrast and provide some suggestions (as detailed as possible) on how it can be used to provide a basis for ensuing research.

A) Learning in networks

Main contrasting issue: convergent vs correct learning.

1. Bala, V. and S. Goyal (1998): "Learning from neighbours," *Review of Economic Studies* **65**, 595-621.
2. Golub, B. and M. Jackson (2010): "Naive learning in social networks: convergence, influence and the wisdom of crowds," *American Economic Journal: Microecnomics* 2, 112-49.
3. González, J.C., V. Eguiluz, M. Marsili, F. Vega-Redondo, M. San Miguel (2010): "Threshold social dynamics in social networks," mimeo.

B) Trading in networks

Main contrasting issue: Ex-ante vs ex post investments, markets vs bargaining in trading networks.

1. Kranton, R. and D. Minehart (2001): "A theory of buyer-seller networks," *American Economic Review* **91**, 485-508.
2. Polanski,A. (2007): "Bilateral bargaining in networks," *Journal of Economic Theory*, **134**, 557-565.
3. Elliott, M. (2009): "Inefficiencies in networked markets," working paper, Stanford University.

C) Homophily in social networks

Main contrasting issue: preference vs. search in homophilus connections.

1. Currarini, S., M. Jackson, and P. Pin (2009): "An economic model of frienship, homophily, minorities, and segregation," *Econometrica* **88**, 1003-1045.
2. Currarini, S. and F. Vega-Redondo (2010): "Homophily and Search," EUI WP.

D) The evolution of trust and cooperation in social networks

Main contrasting issue: Fixed vs. evolving social network, spatial dimension.

1. Karlan, D., M. Mobius, T. Rosenblat, and A. Szeidl (2009): "Trust and Social Collateral," *Quarterly Journal of Economics* 1**24**, 1307-1361.
2. Duernecker, G. and F. Vega-Redondo (2010): "Social networks, institutions, and the process of globalization," mimeo.

E) Risk sharing and contagion in financial networks

Main contrasting issue: Credit markets vs. securitization.

1. Allen, F, A. Babus, and E. Carletti (2010): "Financial Connections and Systemic Risk," mimeo.
2. Cabrales, A., P. Gottardi, and F. Vega-Redondo (2010)): "Risk sharing and contagion in networks," EUI WP.

F) Playing games in networks

Main contrasting issue: Complete versus incomplete information.

1. Bramoullé, Y., R. Kranton, and M. D'Amours (2009): "Strategic Interaction and Networks, mimeo.
2. Galeotti, A., S. Goyal, M. Jackson, F. Vega-Redondo, L. Yariv (2010): "Network games," *Review of Economic Studies* **77**.