



**Course:** Networks

**Faculty:** Pau Milán

**Term:** Spring

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**Office Hours:** Upon request

## Description

Social networks often determine exchange opportunities for trading goods and for launching creative partnerships. They diffuse political opinions, gossip, ideas and job offers. Sometimes they act as a large collective brain, aggregating information and thoughts wisely, and sometimes not so wisely. They affect how we value different goods and activities, and they provide essential insurance against a variety of contingencies which lie beyond the reach of formal insurance schemes. They are also the basic platform for wielding the sticks and carrots prescribed by many social norms. Furthermore, we often directly derive significant well being from our social relationships. It is thus plausible that social networks play a central role in our lives, and in particular in our economic lives.

**The two main goals** of the course are: (1) to introduce the methods used by the social networks literature using ; (2) to help you identify cutting-edge research opportunities.

A unifying question throughout the course will be: What insights has the networks approach brought to previously standing questions in economics?

## Logistics

The course lasts for 30 hours. We will discuss the basic concepts and developments of the literature in 6 broad topics (1) Network Formation, (2) Diffusion and Learning (3) Network Games (4) Networked Markets (5) Empirical Methods (6) Cooperative game theory concepts in networks. I will structure these discussions around the corresponding chapters on Matt Jackson's book (see below) and will often use some time to discuss in more detail one or at most two related papers.

The 5 remaining class sessions will be structured around discussing current and recent research. The applications that we will study lie in some of the following 6 broad areas: (1) Network formation and structure (2) information diffusion, aggregation, and learning (3) strategic communication (4) trade and bargaining (5) labor markets (6) financial networks. We will be studying theoretical and empirical papers. Additionally we will devote a few sessions to discuss applications to (\*) social interactions, influence, and peer effects, as noted above.

## Text Books

The theory and methods part of the course will mostly follow **Matthew O. Jackson's book** "Social and Economic Networks". We might also look at some selected parts from Fernando Vega Redondo's "Complex Social Networks". For completeness, I attach a full list of textbooks on the topic:

- Easley, David, and Jon Kleinberg. *Networks, Crowds, and Markets*. Cambridge: Cambridge University Press, 2010.
- Goyal, Sanjeev. *Connections: an introduction to the economics of networks*. Princeton University Press, 2012.
- Jackson, Matthew O. *Social and economic networks*. Princeton University Press, 2010.
- Newman, Mark. *Networks: an introduction*. Oxford University Press, 2009.
- Vega-Redondo, Fernando. *Complex social networks*. Vol. 44. Cambridge University Press, 2007.
- Wasserman, Stanley, and Katherine Faust. *Social network analysis: Methods and applications*. New York: Cambridge University, 1994.

In any case, the textbook is only a source of reference. As a second year topics course, we will spend most of the time reading articles on the various topics.

# Program and Reading List

The first half of the course introduces the main theoretical foundations for analyzing networks. It is divided into three parts, covering strategic interactions along predetermined (exogenous) social structures, strategic formation of social connections, and the analysis of networks as conduits of information. The second half of the course is more empirical. It looks at recent work with network data on high-school peer groups, small-scale rural economies, and supply chain networks. Finally, if time permits, we will briefly discuss some of the econometric challenges relating to networks.

## 1 Theory

### 1.1 Games on Networks

#### Strategic Interactions

1. Ballester, Coralio, Antoni CalvArmengol, and Yves Zenou. "Who's who in networks. wanted: the key player." *Econometrica* 74, no. 5 (2006): 1403-1417.
2. Bramoullé, Yann, and Rachel Kranton. "Public goods in networks." *Journal of Economic Theory* 135, no. 1 (2007): 478-494.
3. Bramoullé, Yann, Rachel Kranton, and Martin DAmours. "Strategic interaction and networks." (2011).
4. Calvó-Armengol, Antoni. "Stable and efficient bargaining networks." *Review of Economic Design* 7, no. 4 (2003): 411-428.
5. Galeotti, Andrea, Sanjeev Goyal, Matthew O. Jackson, Fernando Vega-Redondo, and Leeat Yariv. "Network games." *The Review of Economic Studies* 77, no. 1 (2010): 218-244.

#### Communication in Networks:

1. Calv-Armengol, Antoni, and Joan De Mart. "Communication networks: Knowledge and decisions." *The American Economic Review* 97.2 (2007): 86-91.
2. Galeotti, Andrea, Christian Ghiglino, and Francesco Squintani. "Strategic information transmission networks." *Journal of Economic Theory* (2013).
3. Hagenbach, Jeanne, and Frdric Koessler. "Strategic communication networks." *The Review of Economic Studies* 77, no. 3 (2010): 1072-1099.

4. Galeotti, Andrea, Sanjeev Goyal, Matthew O. Jackson, Fernando Vega-Redondo, and Leeat Yariv. "Network games." *The Review of Economic Studies* 77, no. 1 (2010): 218-244.

### **Trade and Bargaining:**

1. Calv-Armengol, Antoni. "Stable and efficient bargaining networks." *Review of Economic Design* 7, no. 4 (2003): 411-428.
2. Corominas-Bosch, Margarida. "Bargaining in a network of buyers and sellers." *Journal of Economic Theory* 115, no. 1 (2004): 35-77.
3. Kranton, Rachel E., and Deborah F. Minehart. "A Theory of Buyer-Seller Networks." *The American Economic Review* 91, no. 3 (2001): 485-508.
4. Manea, Mihai. "Bargaining in stationary networks." *The American Economic Review* 101.5 (2011): 2042-2080.
5. Melendez-Jimnez, Miguel A. "A bargaining approach to coordination in networks." *international Journal of game Theory* 37, no. 3 (2008): 439-456.
6. Talams, Eduard. "Prices and Efficiency in Networked Markets." (2016).

### **Risk Sharing:**

1. Ambrus, Attila, Arun G. Chandrasekhar, and Matt Elliott. Social investments, informal risk sharing, and inequality. No. w20669. National Bureau of Economic Research, 2014.
2. Ambrus, Attila, Wayne Y. Gao, and Pau Miln. "Informal Risk Sharing with Local Information." (2016).
3. Bloch, Francis, Garance Genicot, and Debraj Ray. "Informal insurance in social networks." *Journal of Economic Theory* 143, no. 1 (2008): 36-58.
4. Bramoull, Yann, and Rachel Kranton. "Risk-sharing networks." *Journal of Economic Behavior and Organization* 64, no. 3 (2007): 275-294.

## **1.2 Network Formation**

### **Stability Notions:**

1. Jackson, Matthew O., and Asher Wolinsky. "A strategic model of social and economic networks." *Journal of economic theory* 71, no. 1 (1996): 44-74.

2. Jackson, Matthew O., and Anne Van den Nouweland. "Strongly stable networks." *Games and Economic Behavior* 51, no. 2 (2005): 420-444.
3. Jackson, Matthew O., Tomas Rodriguez-Barraquer, and Xu Tan. "Social capital and social quilts: Network patterns of favor exchange." *The American Economic Review* 102.5 (2012): 1857-1897.

### **Strategic Formation**

1. Bala, Venkatesh, and Sanjeev Goyal. "A noncooperative model of network formation." *Econometrica* 68, no. 5 (2000): 1181-1229.
2. Bloch, Francis, and Matthew O. Jackson. "The formation of networks with transfers among players." *Journal of Economic Theory* 133, no. 1 (2007): 83-110.
3. Bramoullé, Yann, Dunia Lopez-Pintado, Sanjeev Goyal, and Fernando Vega-Redondo. "Network formation and anti-coordination games." *International Journal of Game Theory* 33, no. 1 (2004): 1-19.
4. Cabrales, Antonio, Antoni Calv-Armengol, and Yves Zenou. "Social interactions and spillovers." *Games and Economic Behavior* 72.2 (2011): 339-360.
5. Currarini, Sergio, Matthew O. Jackson, and Paolo Pin. "An economic model of friendship: Homophily, minorities, and segregation." *Econometrica* 77, no. 4 (2009): 1003-1045.
6. Galeotti, Andrea, and Sanjeev Goyal. "The law of the few." *The American Economic Review* 100.4 (2010): 1468-1492.
7. Goyal, Sanjeev, and Fernando Vega-Redondo. "Network formation and social coordination." *Games and Economic Behavior* 50, no. 2 (2005): 178-207.

## **1.3 Diffusion and Learning on Networks**

### **Naive Learning:**

1. DeGroot, M. H. (1974). Reaching a consensus. *Journal of the American Statistical Association*, 69(345), 118-121.
2. Golub, Benjamin, and Matthew O. Jackson. Naive learning in social networks and the wisdom of crowds. *American Economic Journal: Microeconomics* 2, no. 1 (2010): 112-149.

3. Jadbabaie, A., Molavi, P., Sandroni, A., & Tahbaz-Salehi, A. (2012). Non-Bayesian social learning. *Games and Economic Behavior*, 76(1), 210-225.
4. Mueller-Frank, M. (2014). Does one Bayesian make a Difference?. *Journal of Economic Theory*, 154, 423-452.

### **Social Learning:**

1. Bala, Venkatesh, and Sanjeev Goyal. " Learning from neighbours." *The Review of Economic Studies* 65, no. 3 (1998): 595-621.
2. Bala, Venkatesh, and Sanjeev Goyal. " Conformism and diversity under social learning." *Economic Theory* 17, no. 1 (2001): 101-120.
3. Gale, Douglas, and Shachar Kariv. "Bayesian learning in social networks." *Games and Economic Behavior* 45, no. 2 (2003): 329-346.

### **Diffusion:**

1. Banerjee, Abhijit, Arun G. Chandrasekhar, Esther Duflo, and Matthew O. Jackson. "The diffusion of microfinance". No. w17743. National Bureau of Economic Research, 2012.
2. Morris, Stephen. "Contagion." *The Review of Economic Studies* 67, no. 1 (2000): 57-78.
3. Young, H. Peyton. "Innovation diffusion in heterogeneous populations: Contagion, social influence, and social learning." *The American economic review* 99, no. 5 (2009): 1899-1924.

## **2 Applications**

### **2.1 Peer Effects**

1. Bramoull, Yann, Habiba Djebbari, and Bernard Fortin. "Identification of peer effects through social networks." *Journal of econometrics* 150, no. 1 (2009): 41-55.
2. Bursztyn, L., Egorov, G., & Jensen, R. (2017). Cool to be Smart or Smart to be Cool? Understanding Peer Pressure in Education (No. w23020). National Bureau of Economic Research. Chicago

3. Bursztyn, L., & Jensen, R. (2015). How Does Peer Pressure Affect Educational Investments?. *The quarterly journal of economics*, qjv021.
4. Calv-Armengol, Antoni, Eleonora Patacchini, and Yves Zenou. "Peer effects and social networks in education." *The Review of Economic Studies* 76, no. 4 (2009): 1239-1267.
5. Christakis, Nicholas A., and James H. Fowler. "The spread of obesity in a large social network over 32 years." *New England journal of medicine* 357, no. 4 (2007): 370-379.
6. Glaeser, Edward L., Bruce Sacerdote, and Jose A. Scheinkman. "Crime and social interactions." *The Quarterly Journal of Economics* 111, no. 2 (1996): 507-548.
7. Moody, James. "Race, School Integration, and Friendship Segregation in America<sup>1</sup>." *American Journal of Sociology* 107, no. 3 (2001): 679-716.

## 2.2 Informal Insurance

1. Angelucci, Manuela, Giacomo De Giorgi, Marcos Rangel, and Imran Rasul. Insurance and investment within family networks. No. id: 2649. 2010.
2. Comola, Margherita. "The network structure of mutual support links: Evidence from rural Tanzania." Available at SSRN 946093 (2010).
3. Conley, Timothy G., and Christopher R. Udry. "Learning about a new technology: Pineapple in Ghana." *The American Economic Review* (2010): 35-69.
4. De Weerd, Joachim, and Stefan Dercon. "Risk-sharing networks and insurance against illness." *Journal of Development Economics* 81, no. 2 (2006): 337-356.
5. Fafchamps, Marcel, and Flore Gubert. "The formation of risk sharing networks." *Journal of Development Economics* 83, no. 2 (2007): 326-350.
6. Karlan, Dean, Markus Mobius, Tanya Rosenblat, and Adam Szeidl. "Trust and social collateral." *The Quarterly Journal of Economics* 124, no. 3 (2009): 1307-1361.
7. Kinnan, Cynthia, and Robert Townsend. "Kinship and Financial Networks, Formal Financial Access, and Risk Reduction." *The American Economic Review* 102, no. 3 (2012): 289-293.
8. Milán, Pau, Michael Gurven, Paul Hooper, and Hillard Kaplan. "Partial Insurance Networks: Food Sharing in Tsimane' Villages" (2017).
9. Putnam, Robert D. *Bowling alone: The collapse and revival of American community*. Simon and Schuster, 2001.

## 2.3 Production Networks

1. Acemoglu, Daron, Vasco M. Carvalho, Asuman Ozdaglar, and Alireza TahbazSalehi. "The network origins of aggregate fluctuations." *Econometrica* 80, no. 5 (2012): 1977-2016.
2. Acemoglu, Daron, Asuman Ozdaglar, and Alireza Tahbaz-Salehi. *Networks, shocks, and systemic risk*. No. w20931. National Bureau of Economic Research, 2015.
3. Carvalho, Vasco M. "From micro to macro via production networks." *The Journal of Economic Perspectives* 28.4 (2014): 23-47.
4. Carvalho, Vasco M., et al. "Supply chain disruptions: Evidence from the great east japan earthquake." (2016).
5. Jen Lao's work

## 3 Econometric Analysis of Networks

### 3.1 Identification

1. Manski, Charles F. "Identification of endogenous social effects: The reflection problem." *The review of economic studies* 60, no. 3 (1993): 531-542.
2. Chandrasekhar, Arun G., and Randall Lewis. "Econometrics of sampled networks." Unpublished manuscript, MIT.[422] (2011).
3. Bramoull, Yann, Habiba Djebbari, and Bernard Fortin. "Identification of peer effects through social networks." *Journal of econometrics* 150, no. 1 (2009): 41-55.
4. Blume, Lawrence E., William A. Brock, Steven N. Durlauf, and Yannis Ioannides. "Identification of social interactions." (2010).

### 3.2 Estimating Networks from Data

1. Manresa, Elena. "Estimating the structure of social interactions using panel data." Unpublished Manuscript. CEMFI, Madrid (2013).
2. Gualdani, Cristina. "Estimating spillover effects in the formation of financial networks" Unpublished Manuscript. (2017).
3. Aureo de Paula's work



## Grading

Grades will be based on the following three components, and computed by using the corresponding weights : (1) problem sets (20%) (2) student presentations (30%), and (3) a final project (50%). The final project may either consist of a take-home exam or a monograph (research proposal, literature review).