An Introduction to the Econometrics of Networks

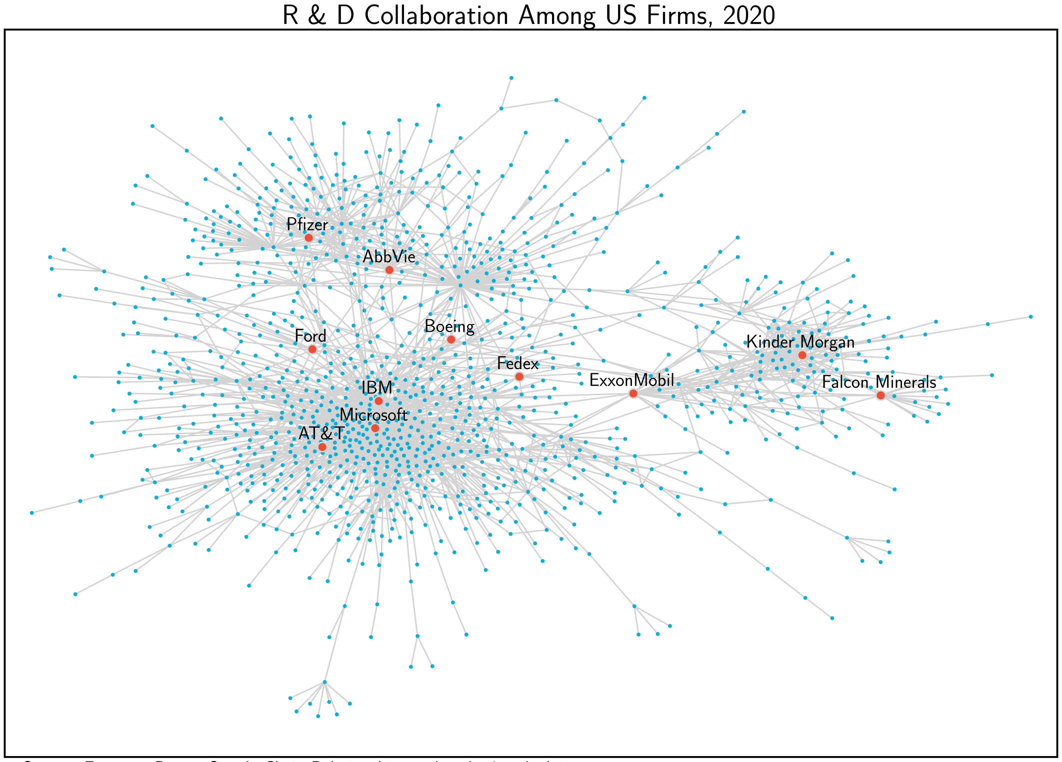
University of St. Gallen

November 28th to December 2nd, 2022

Course Description

This course will provide a selective introduction to econometric methods appropriate for the analysis of social and economic networks. We will begin by introducing some basic results on U-Statistics and U-Process minimizers. These results will then be adapted to study dyadic regression (e.g., gravity models of trade). We will then turn to methods of simulating adjacency matrices subject to constraints. These methods will be used to construct tests for whether agents behave strategically when forming links.

R & D Collaboration Among US Firms, 2020



Source: Factset - Revere Supply Chain Relationships and author's calculations.
Raw data available (by subscription) at https://wrds-web.wharton.upenn.edu/wrds/ (Accessed September 2022)

Course Logistics

Instructor: Bryan Graham, Department of Economics, University of California - Berkeley

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Time: To be scheduled.

Prerequisites: The equivalent of a first year Ph.D. level sequence in econometrics. Specifically an understanding of probability and statistical inference at the level of Casella and Berger (1990, *Statistical Inference*), linear regression analysis at the level of Goldberger (1991, *A Course in Econometrics*) and some exposure to non-linear models (e.g., maximum likelihood, M-estimation, GMM). I will also assume a basic knowledge of applied linear/matrix algebra.

Textbook: Readings preceded by a [r] in the course outline are "required" (i.e., should ideally be read prior to class), while those preceded by a [b] are for "background" (i.e., may be useful for students interested in additional material or empirical applications). Students may find the book by Graham & de Paula (2020) useful (available for purchase here). We will also make use of my recent *Handbook of Econometrics* chapter (Graham, 2020). This chapter is available one ScienceDirect here. The forthcoming book by Goyal (2023) is an excellent introduction to the underlying game theory of networks. The survey by Goldenberg et al. (2009) covers much of the technical literature in statistics and machine learning, but is now dated.

Course Outline (Tentative/Subject to Revision)

Date	Topic	Readings
11/28	**Hajek Projection, U-Statistics & U-Process Minimizers**	[r] Ferguson (2005) [r] Honoré & Powell (1994) [b] van der Vaart (2000, Ch. 11-12)
11/29	**Dyadic Regression**	[r] Menzel (2021) [b] Graham (2020, Sections 3-4), Davezies et al. (2021) [b] Diaconis & Janson (2008)
11/30	**Sparseness & Heterogeneity**	[r] Graham (2022) [r] Graham (2017), Jochmans (2018) [b] Bickel et al. (2011)
12/1	**Network Simulation**	[r] Blitzstein & Diaconis (2011) [b] Graham & Pelican (2020)
12/2	**Strategic Interaction**	[r] Pelican & Graham (2019) [r] Miyauchi (2016) [b] de Paula (2013), de Paula (2020)

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Graham, B. S. (2020). *Handbook of Econometrics*, volume 7, chapter Network data, (pp. 111 – 218). North-Holland: Amsterdam, 1st edition.

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Pelican, A. & Graham, B. S. (2019). *An optimal test for strategic interaction in social and economic network formation between heterogeneous agents*. NBER Working Paper 27793, National Bureau of Economic Research.

van der Vaart, A. W. (2000). *Asymptotic Statistics*. Cambridge: Cambridge University Press.