The Network of Foreign Direct Investment Flows

John Schoeneman, Boliang Zhu, & Bruce Desmarais
Pennsylvania State University

Introduction

The political economy of FDI literature has established several theoretical claims and empirical regularities regarding exogenous political and economic determinants of FDI inflows. However, existing studies—based on monadic and to a lesser degree, dyadic regression models—overlook the complex dependencies that are likely to characterize the network.

In this paper, we integrate hypotheses regarding exogenous determinants and novel hypotheses regarding structural dependencies into a comprehensive exponential random graph model (ERGM) for weighted networks.[1]

Dependence Hypotheses

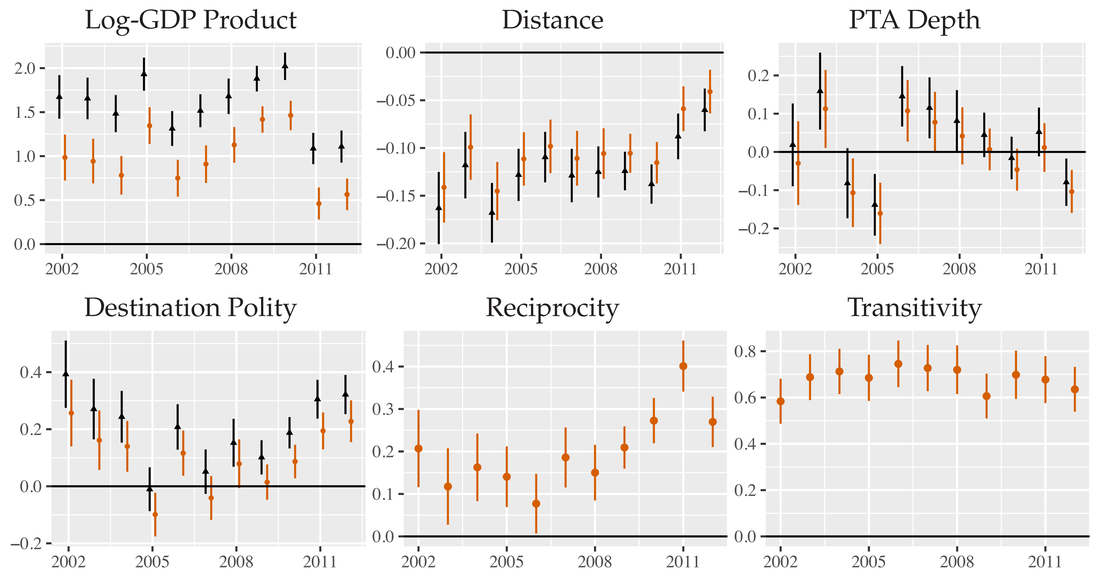
MNC expansion via FDI often faces opposition from host countries due to concerns over national security and protection for local firms that do not want to compete with foreign firms. To overcome this political opposition, countries enter into reciprocal agreements. Therefore we expect one structural dependency to be reciprocity. For the model reciprocity is defined as:

$$\sum_{(i,j)\in\mathbb{Y}} min(\boldsymbol{y}_{i,j}, \boldsymbol{y}_{j,i})$$

The second structural dependency we model is transitivity, or the likelihood that country A, will send FDI to country C, given that country A sends FDI to country B and country B send FDI to country C. We expect this clustering as a result of the increasingly fragmented global supply chains for production that have been expanded through preferential trade agreements and the vertical FDI that follows due to the reduction in the risk of expropriation. For the model transitivity is defined as:

$$\sum_{(i,j)\in\mathbb{Y}} \min\left(\boldsymbol{y}_{i,j}, \max_{k\in N}\left(\min(\boldsymbol{y}_{i,k}, \boldsymbol{y}_{k,j})\right)\right)$$

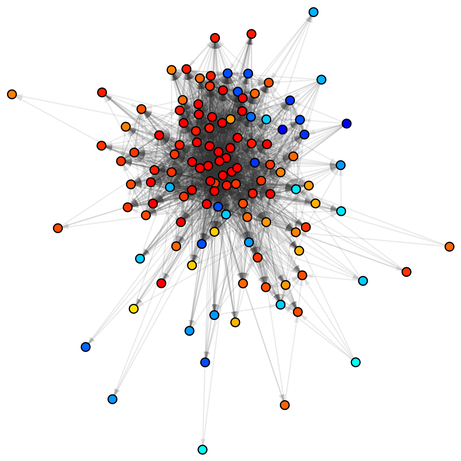
Select Results

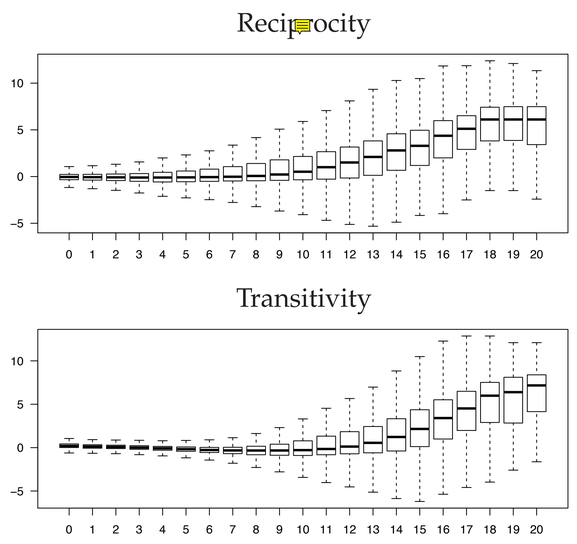


Bars represents 95% Confidence intervals. Black triangles are coefficient estimates without controlling for network dependencies. Orange circles are estimates with network controls.

Structural Dependency Plots

Plot for 2011: Scale from Blue to red represents autocratic regimes to democratic regimes





Model Specification

- Dependent Variable
  - Bilateral FDI statistics, 2001-2012
- Network Statistics
  - Sum; Sum$^{1/2}$; Non-zero; Reciprocity; Transitive Weights
- Dyad-level Covariates (expected)
  - Gravity(+); Contiguity(+); Common Language(+); Four Types of Defense Treaties(+); Colonial Relationships(+); PTA depth(+)
- Node-level Covariates (sender/receiver)
  - GDP per capita(+/-); GDP Growth Rate(+/+); Polity IV(+/+); Political Violence(-/-); Trade Openness(+)

Discussion

Select Results: To assess model fit and compare exogenous covariate estimates when network statistics are excluded, we fit models with and without the network dependency terms. For every year the model was fit, we saw a decrease in the Bayesian Information Criterion. The plots show that the estimates of exogenous covariates shift opposite of the expected direction, moving from significant at the 95% level to insignificant in some cases, and the dependency terms are significant for every year.

Structural Dependency Plots: In the plot for the FDI network in 2011 both clustering and reciprocity are visually evident. The box-plots on the right show that edge values are are increasingly underestimated when only using exogenous covariates (y-axis) as the values increase for each structural dependence (x-axis). (e.g. For reciprocity, when edge $y_{j,i}$ is 15, $y_{i,j}$ is underestimated by 3 log-scale units. For transitivity the x-axis is the minimum edge value in a two-path.)

Acknowledgement

This material is based on work supported by the National Science Foundation under IGERT Grant DGE-1144860, Big Data Social Science.

Reference

1. Krivitsky, Pavel N. 2016. ergm.count: Fit, Simulate and Diagnose Exponential-Family Models for Networks with Count Edges. The Statnet Project (http://www.statnet.org). R package version 3.2.2. http://CRAN.R-project.org/package=ergm.count

Contact Information

Department Political Science, Pond Labratory
Web github.com/desmarais-lab
Email jbs5686@psu.edu