The Network of Foreign Direct Investment Flows: Theory and Empirical Analysis[1]

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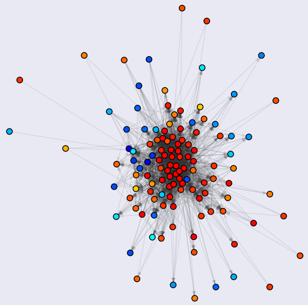
Introduction

- FDI as a Network
    - Clustering
    - Reciprocity
- Motivation
    - Violation of Independence Assumptions
    - Theoretical Importance of Dependence Terms
- Simultaneously test exogenous variables

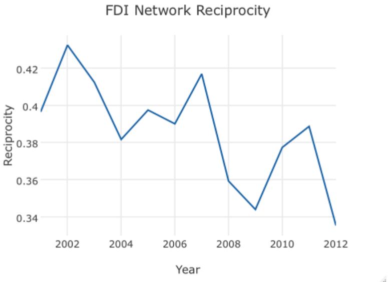
FDI Network 2008



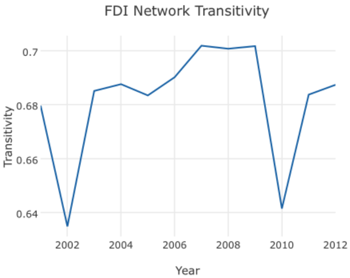
Color Scheme: Autocracy to Democracy is scaled as Blue to Red

Theory for Network Terms

- Reciprocity
  - Standard practice to resolve political opposition from competing firms
  - Anti-reciprocal relationship in mixed dyads



- Transitivity
  - MNC expansion and supply-chain fragmentation
  - Risk of Expropriation
  - PTA networks



FDI Data and Exogenous Covariates

- Bilateral FDI statistics from UNCTAD, 2001-2012

- Dyad-level Covariates
  - Gravity +
  - Contiguity +
  - Common Language +
  - Four Types of Defense Treaties +
  - Colonial Relationships +
  - PTA depth[1] +

- Node-level Covariates
  - GDP per capita +/-
  - GDP Growth Rate +
  - Polity IV +
  - Political Violence -
  - Trade Openness +

ERGM Count Model: Base

$$\Pr_{\boldsymbol{\theta};h;\boldsymbol{g}}(\boldsymbol{Y} = \boldsymbol{y}) = \frac{h(\boldsymbol{y})\exp(\boldsymbol{\theta} \cdot \boldsymbol{g}(\boldsymbol{y}))}{\boldsymbol{\kappa}_{h,\boldsymbol{g}}(\boldsymbol{\theta})}$$

$$\text{Sum} : \boldsymbol{g}(\boldsymbol{y}) = \sum_{(i,j)\in\mathbb{Y}} \boldsymbol{y}_{i,j}$$

$$\text{Sum, Fractional Moment} : \boldsymbol{g}(\boldsymbol{y}) = \sum_{(i,j)\in\mathbb{Y}} \boldsymbol{y}_{i,j}^{1/2}$$

$$\text{Non-Zero} : \boldsymbol{g}_k = \sum_{(i,j)\in\mathbb{Y}} \mathbb{I}(\boldsymbol{y}_{i,j} \neq 0)$$

ERGM Count Model: Variables

$$\text{Reciprocity}: \boldsymbol{g}(\boldsymbol{y}) = \sum_{(i,j)\in\mathbb{Y}} min(\boldsymbol{y}_{i,j}, \boldsymbol{y}_{j,i})$$

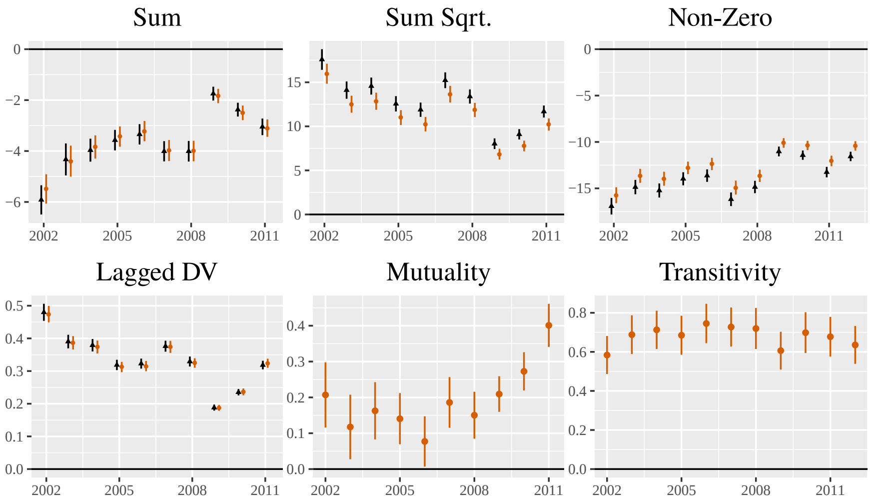
$$\text{Transitive Weights}: \boldsymbol{g}(\boldsymbol{y}) = \sum_{(i,j)\in\mathbb{Y}} \min\left(\boldsymbol{y}_{i,j}, \max_{k\in N}\left(\min(\boldsymbol{y}_{i,k}, \boldsymbol{y}_{k,j})\right)\right),$$

$$\text{Dyadic Covariate}: \boldsymbol{g}(\boldsymbol{y}, \boldsymbol{x}) = \sum_{(i,j)} \boldsymbol{y}_{i,j} x_{i,j}$$

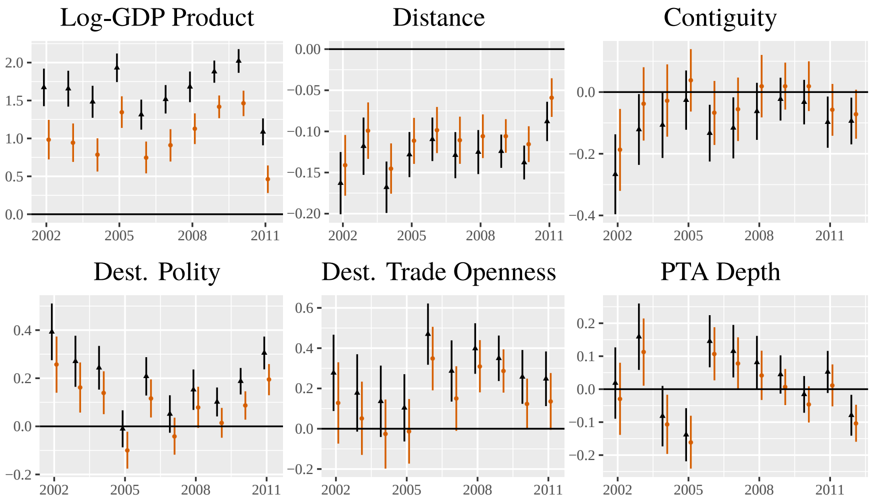
$$\text{Sender Covariate}: \boldsymbol{g}(\boldsymbol{y}, \boldsymbol{x}) = \sum_{i} x_i \sum_{j} \boldsymbol{y}_{i,j}$$

$$\text{Receiver Covariate}: \boldsymbol{g}(\boldsymbol{y}, \boldsymbol{x}) = \sum_{j} x_j \sum_{i} \boldsymbol{y}_{i,j}$$

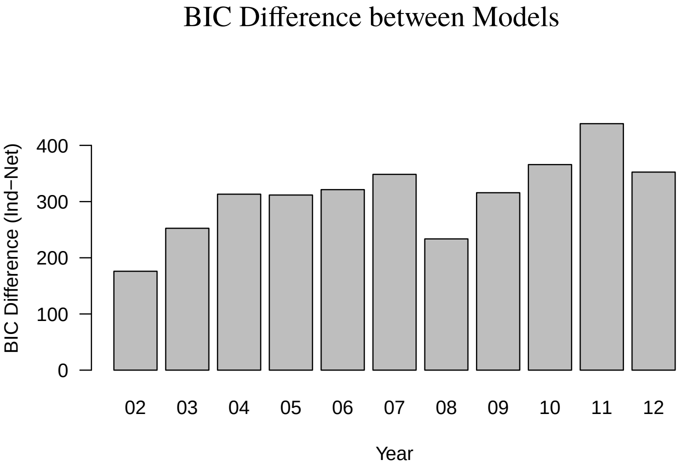
Count Model and Network Dependencies



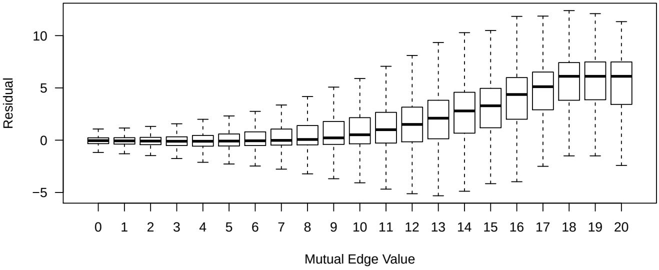
Covariate Results

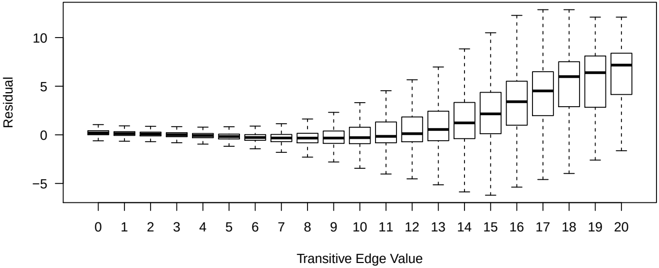


Model Fit and Bias



Residuals for Network Statistics





Conclusion and Future Research

- Conclusion
  - Network terms are substantively important
  - Network terms need to be modeled instead of being assumed away
- Future Steps
  - Condition reciprocity on development
  - Assortativity
  - Cyclical Weights
  - Network dynamics

References

1. Dür, A., Baccini, L., & Elsig, M. (2014). The design of international trade agreements: Introducing a new dataset. The Review of International Organizations, 9(3), 353-375.