

The Network of Foreign Direct Investment Flows: Theory and Empirical Analysis¹

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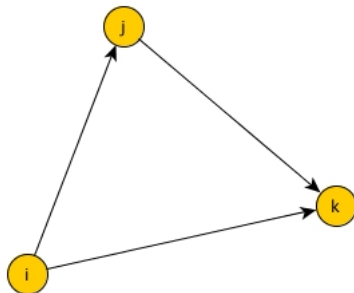
- Motivation
 - Violation of Independence Assumptions
 - Theoretical Importance of Dependence Terms
- FDI as a Network
 - Reciprocity
 - Transitivity
- Simultaneously test exogenous variables

- Reciprocity



- Standard practice to resolve political opposition from competing firms

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

The Exponential Random Graph Model (ERGM)

The probability (likelihood function) of observing the network is:

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

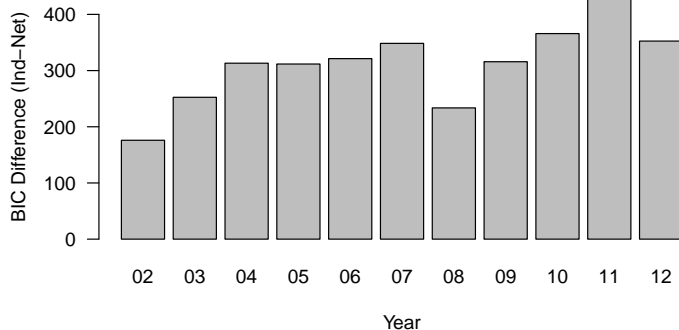
Decomposition:

$\underbrace{h(y)}$	$\underbrace{\theta}$	$\underbrace{g(y)}$	$\underbrace{\kappa_{h,g}(\theta)}$
<i>Distribution</i>	<i>Effects</i>	<i>Net Stats</i>	<i>Normalizer</i>

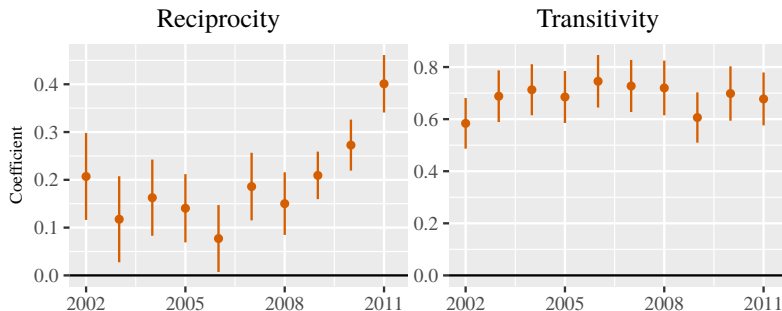
$$\text{Reciprocity : } g(\mathbf{y}) = \sum_{(i,j) \in \mathbb{Y}} \min(\mathbf{y}_{i,j}, \mathbf{y}_{j,i})$$

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

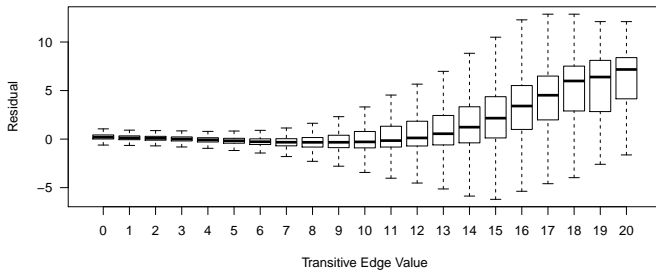
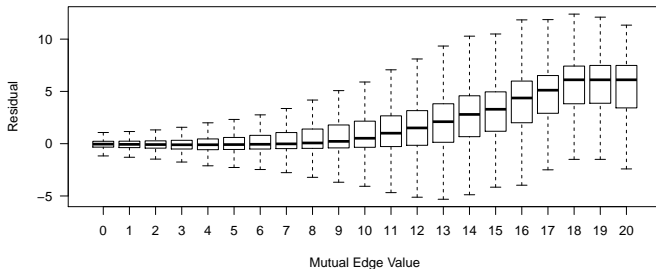
BIC Difference between Models



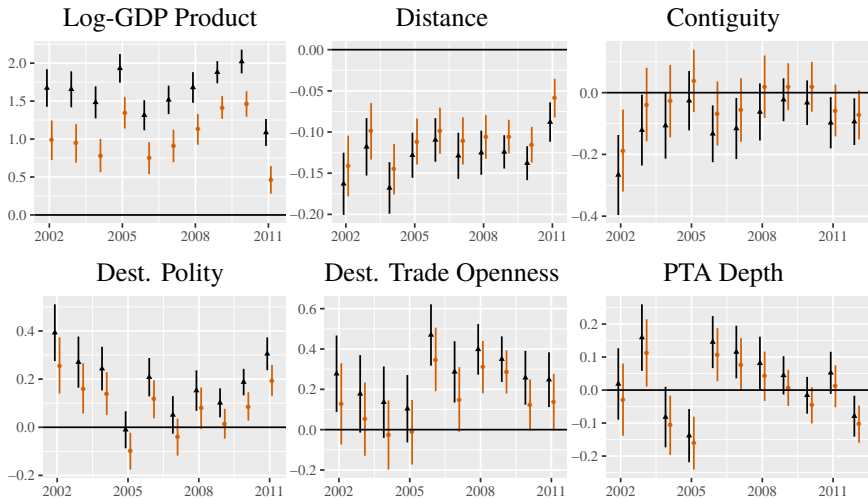
Count Model and Network Dependencies



Network Statistics



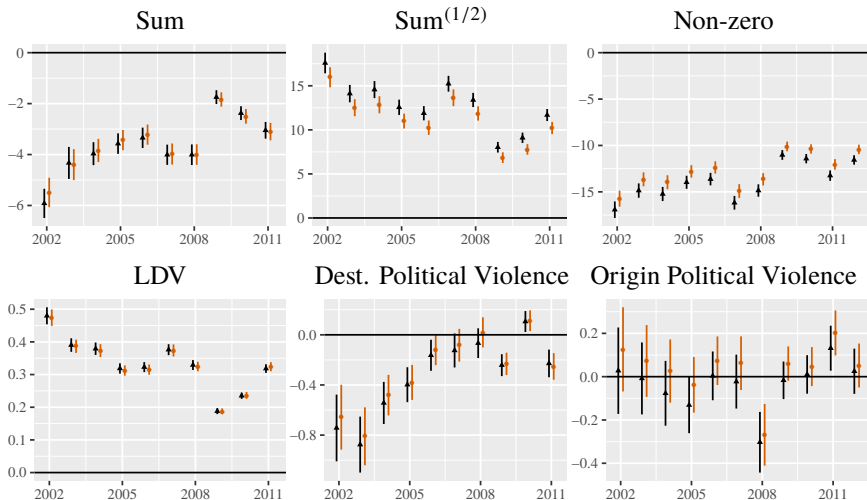
Covariate Results



Conclusion and Future Research

- Network terms are substantively important
- Network terms need to be modeled instead of being assumed away
- Network dynamics

Additional Covariates



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

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

$$\text{Non-Zero : } g_k = \sum_{(i,j) \in \mathbb{Y}} \mathbb{I}(y_{i,j} \neq 0)$$

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

$$\text{Sender Covariate : } g(\mathbf{y}, \mathbf{x}) = \sum_i x_i \sum_j \mathbf{y}_{i,j}$$

$$\text{Receiver Covariate : } g(\mathbf{y}, \mathbf{x}) = \sum_j x_j \sum_i \mathbf{y}_{i,j}$$