Testing for Network Effects in Field Experiments
Examples from Legislative Studies

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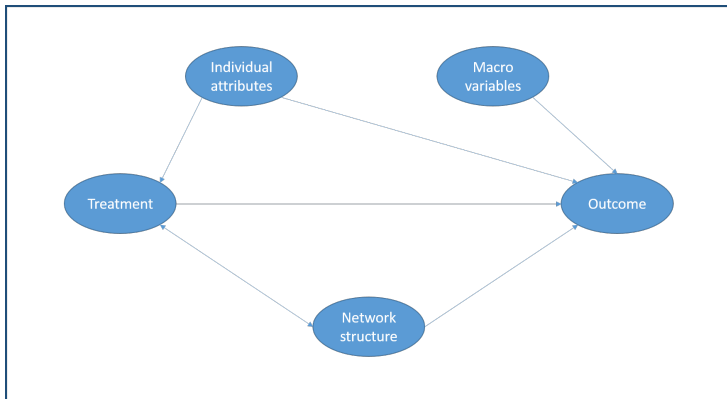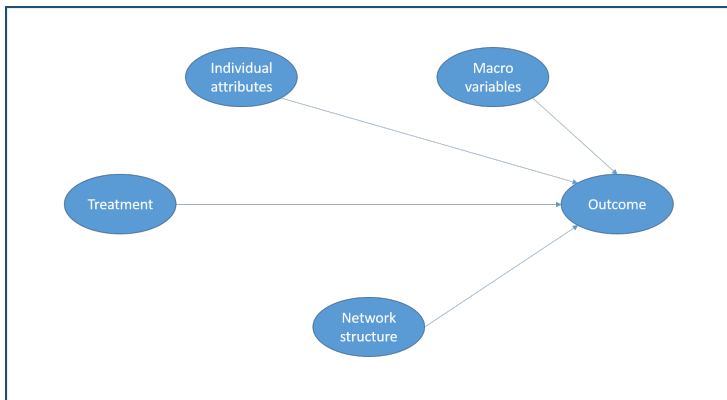[2]Associate Professor
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Political Networks 2016

Overview

Several factors impact the effect of treatment on the outcome

Motivation: Causal diagram

Field experiments eliminate systematic treatment assignment, but not the effect of network

Motivation: Network plot

Stable Unit Treatment Value Assumption (SUTVA)

Assumption that the treatment status of unit does not affect the outcome of another.

Research objectives

- Model spillover of treatment effect via network structures.
- Examine how inferences depend upon the specification of the network and spillover structure.
- Evaluate the models using data from field experiments on US State legislatures.

Method: Review

- Method for modeling and testing for interference effects using non-parametric test under Fisher's inference framework (Bowers, Fredrickson and Panagopoulos (2012))
- Sharp null hypothesis of no effects assumed
- Spillover depends on the number of treated neighbors
- Spillover model specification includes separate parameters for direct and indirect treatment effect
- Kolmogorov-Smirnov (KS) test used to compare treatment and control group under a large number of permutations of treatment assignment

Method: Extensions

- **Neighborhood specification:**
  - Effect from all units
  - Effect from k-nearest neighbors

- **Diffusion model specification:**
  - Distance from the nearest treated node
  - Number/proportion of treated neighbors
  - Form of spread (linear or non-linear)

- **Network selection:**
  - Ideological network
  - Committee network
  - Co-sponsorship network
  - Geographical network network

- **Test statistic selection:**
  - Kolmogorov-Smirnov test
  - Anderson-Darling test
  - Mann-Whitney U test
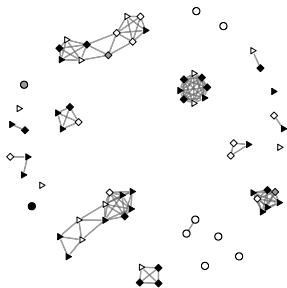 - Control Median test

Application: Coppock (2014)

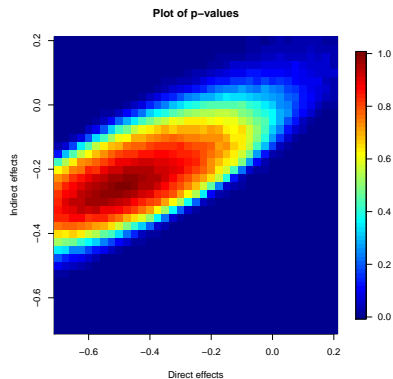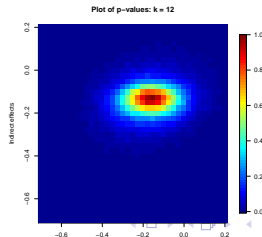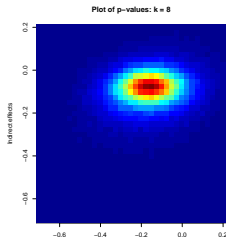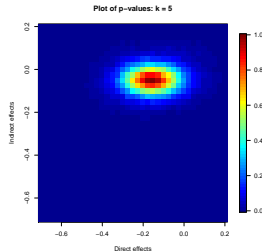Figure: Ideological network: Butler, Nickerson et. al. (2011)

Plot of p-values

Figure: TEMP: Replication of Coppock (2014)

Plots are temporary. Will be changed before the conference. Knn specifications
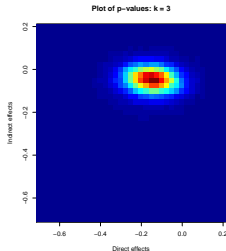
Plots are temporary. Will be changed before the conference. Committee network
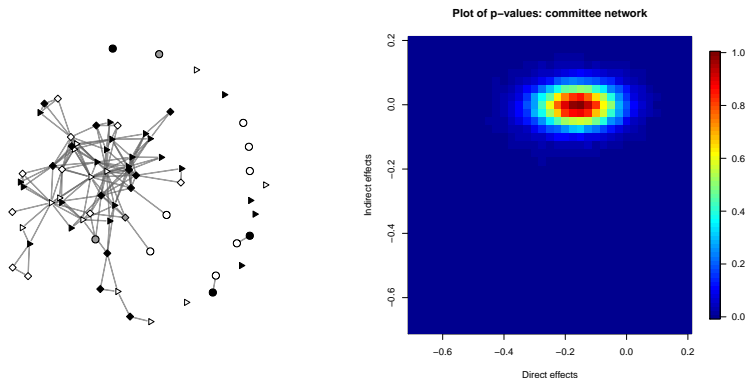

Figure: p-values: Committee network of New Mexico legislators

Application: Bergan and Cole (2015)

Include a network plot and replication p-value plot for Bergan

Summary

- Many domains of political science studies interactive social groups and interference must be modeled in analyzing experiments conducted on them
- Several dimensions must be considered in specifying the model for interference and drawing inferences from the same
- This analysis can be used to perform power calculations and create optimal experimental design

- Next steps
  - Replicate the Brockman (2013) study that includes legislators from multiple states
  - Extend replications along salient dimensions
  - Model a mixture of networks instead of considering a single network

Thank you
Questions?