Contagion Effect Estimate Through the Lens of Different Statistical Methods

Brisilda Ndreka; University on Connecticut, Department of Statistic.

UCONN Dec: 2022

Outline

- Why estimating contagion effect is social science is considered a challenged process?
- Influence model ..
- Method which archive on the better estimation of the true contagion 3effects
- Social studies have proves that estimated including the latent space adjusted approach [**RJ-2018-017**] Xu [2018] with a dynamic linear model [**Friedkin1990SocialIA**] Friedkin & Johnsen [1990].

Introduction

- Contagion effect also referred as social effect is the tendency of a person or group of individuals has to follow the behaviour of some reference group that they participate.
- If unobserved variables that may affect the influence process are not treated properly this leads in potential bias estimation of contagion effect.
- the estimated latent positions from the latent space model can be used as the proxies (Wooldridge, 2011) for the unobserved traits that co-determine influence and selection, and by including the latent positions as additional covariates in the behavioral model it will reduce the bias in the estimation of social influence effects.Different estimation method of latent trait

Where it is coming the problem on identifying social effect (contagion effect)?

Several studies defined that estimation latent variable and involbe in the influence modlel help in bias of cotagion effect

Four estimation studeied:

1. Latent space method
2. SDNE
3. Node2Vec
4. Latent Factor Model

LAtent Sapace Model

SDNE

Nde2vec

Latent Factor Model

Simulation setting

- Four estimation method
- Each of them estimate latent variable using dimension 1 and 3
- Two network size 40 and 80 nodes in two time point each 2 and 5.
- Latent trait affects homophily and influence
- Covariates involved in influence and selection model
- Two involved models respectively defined as:
  - Influlence moddel:

$$Y_{it} = \beta_0 + \beta_1 Y_{it-1} + \beta_2 \frac{\sum Z_{ijt-1} Y_{jt-1}}{\sum Z_{ijt-1}} + \beta_3 X_{it-1} + \beta_3 c_i + \epsilon_{it}$$

  - Selection model:

$$log \;\; odds(Z_{ij} = 1 | c_i, c_j, x_{ij}, \alpha, \beta) = \alpha + \beta' X_{ij} - |c_i - c_j|,$$

Simulation setting

- Two involved models respectively defined as:
  - Influlence moddel:

$$Y_{it} = \beta_0 + \beta_1 Y_{it-1} + \beta_2 \frac{\Sigma Z_{ijt-1} Y_{jt-1}}{\Sigma Z_{ijt-1}} + \beta_3 X_{it-1} + \beta_3 c_i + \epsilon_{it}$$

  - Selection model:

$$log \;\; odds(Z_{ij} = 1 | c_i, c_j, x_{ij}, \alpha, \beta) = \alpha + \beta' X_{ij} - |c_i - c_j|,$$

- beta1 =10.1 0.4 0.7

Simulation Results: Contagion effect

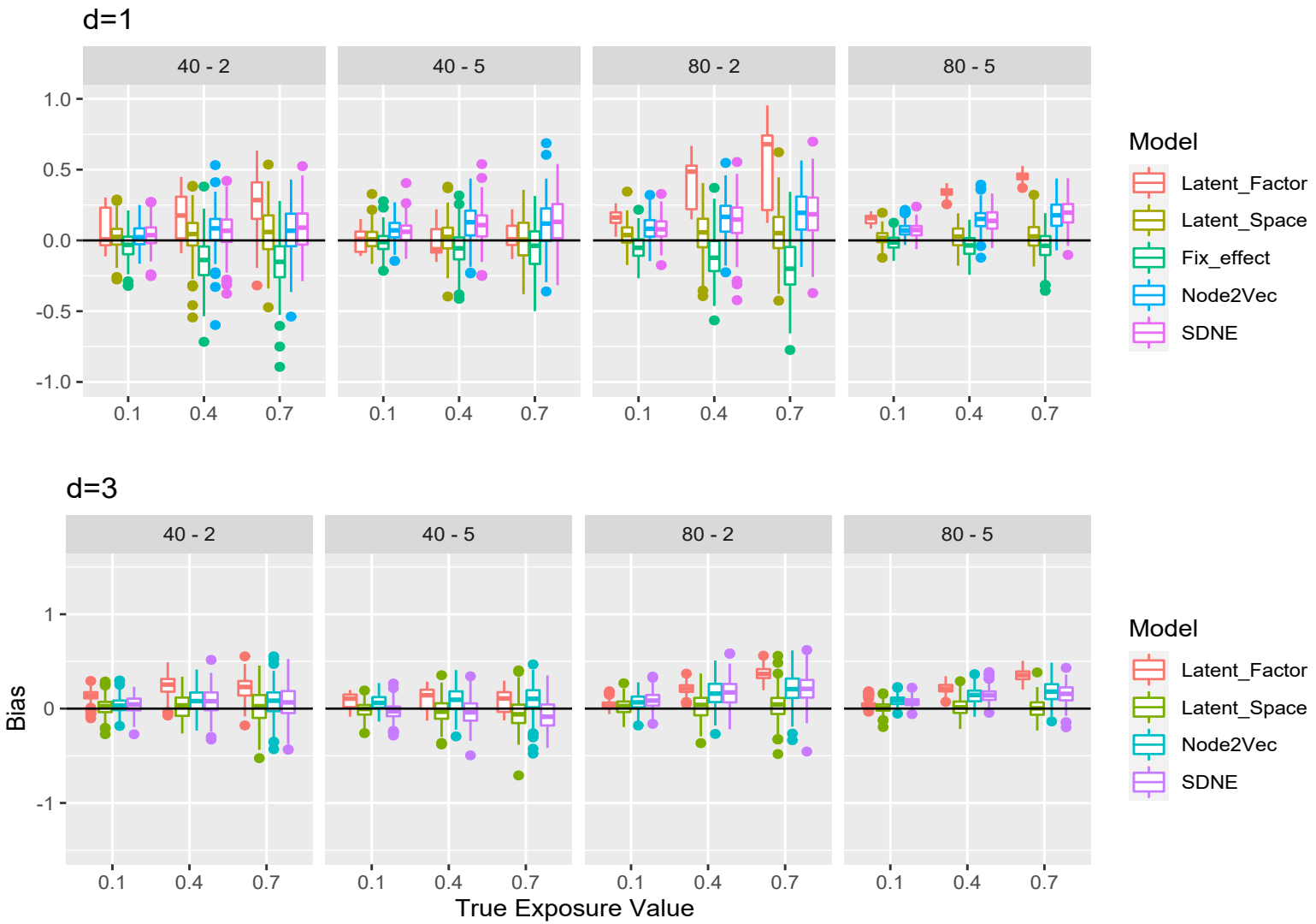
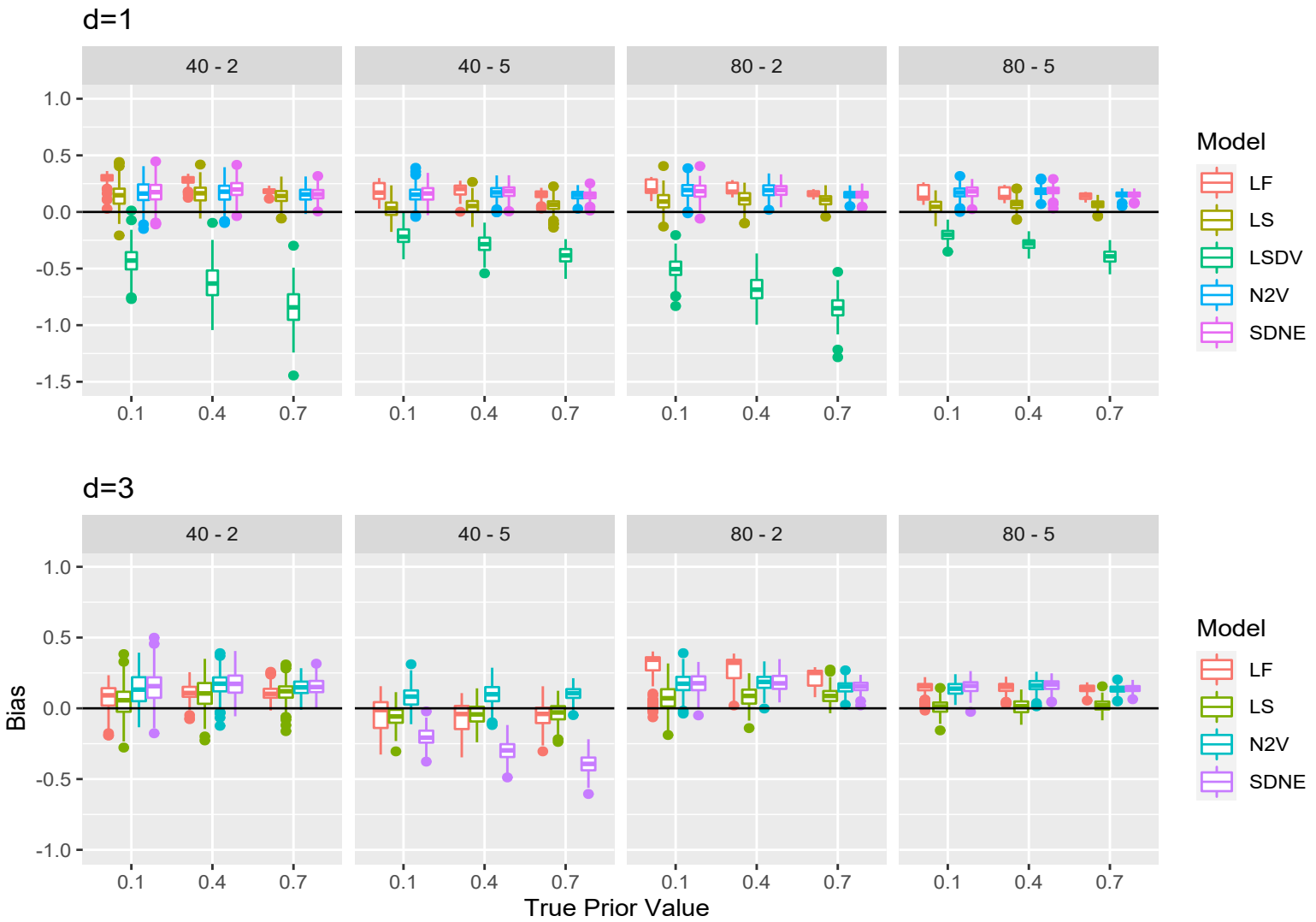


Figure: Bias Distribution for Contagion Effect

Results:

- Latent space adjusted approach produces much smaller bias in estimating the lagged dependent variable when T is small and the true coefficient for lagged dependent variable is large

Simulation Results: Latent trait estimation help with reducing lagged dependent bias as well.



Reference

ref