Law of Large Graphs

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1 Introduction

2 Background

3 Theory

4 Simulations

To demonstrate the previous results for the variance of $\hat{P}$ and Relative Efficiency (Equations x.x and x.x), we simulate random graphs from a SBM with parameters.

$$B = \begin{bmatrix} .42 & .2 \\ .2 & .7 \end{bmatrix}, \qquad \rho = \begin{bmatrix} .5 & .5 \end{bmatrix}$$

From this model we sample M adjacency matrices with N vertices to calculate both $\bar{A}$ and $\hat{P}$. With these estimators for P, we calculate the mean squared error of each block region in the model, defined as edges of the adjacency matrix that have the same edge-wise probability. We then compare these simulations with our predictions.

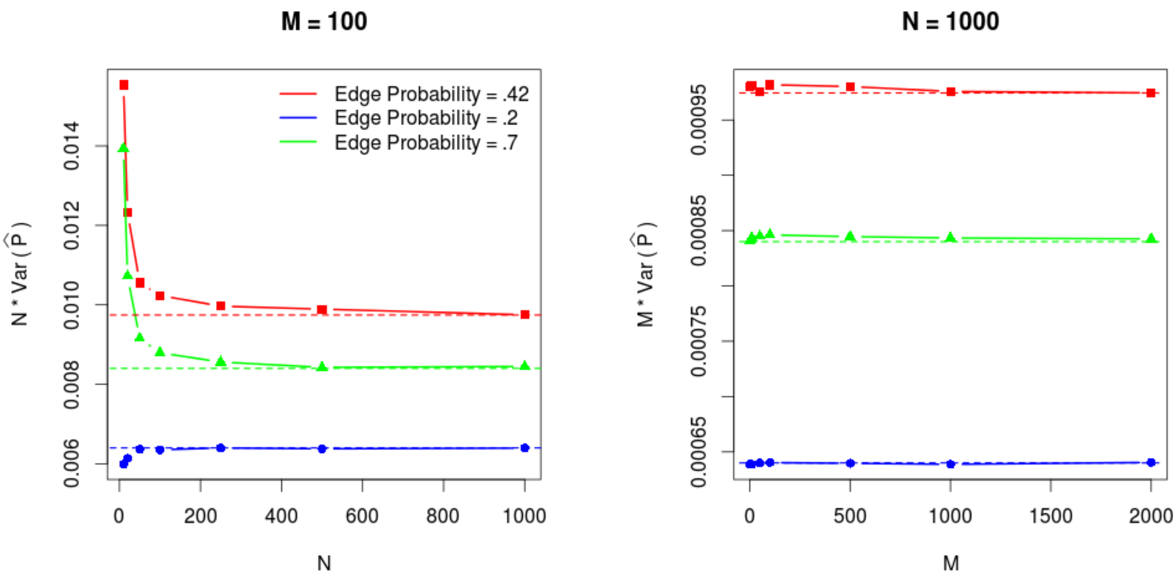

Figure 1: N*Var($\hat{P}$) (a) and M*Var($\hat{P}$) (b) calculated from edges with associated edge probabilities, while increasing N and M, respectively. Observe that the simulated values asymptotically converge to the predictions, represented by the dotted lines.

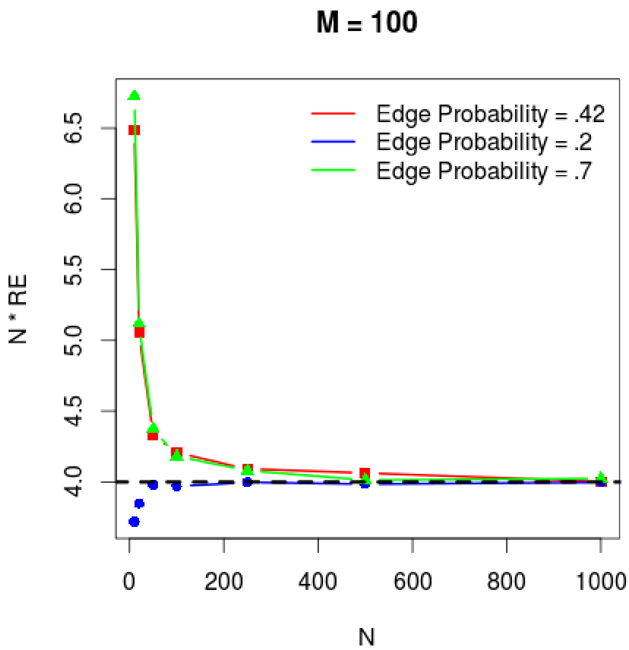

Figure 2: N*RE calculated from edges with associated edge probabilities. Observe that the simulated values asymptotically converge to the predictions, represented by the dotted line.

We now examine simulations where we vary the ρ vector for the SBM with the following parameters:

$$B = \begin{bmatrix} .42 & .2 \\ .2 & .7 \end{bmatrix}, \qquad \rho = \begin{bmatrix} \rho_1 & \rho_2 \end{bmatrix}, \qquad N = 500, \qquad M = 100$$

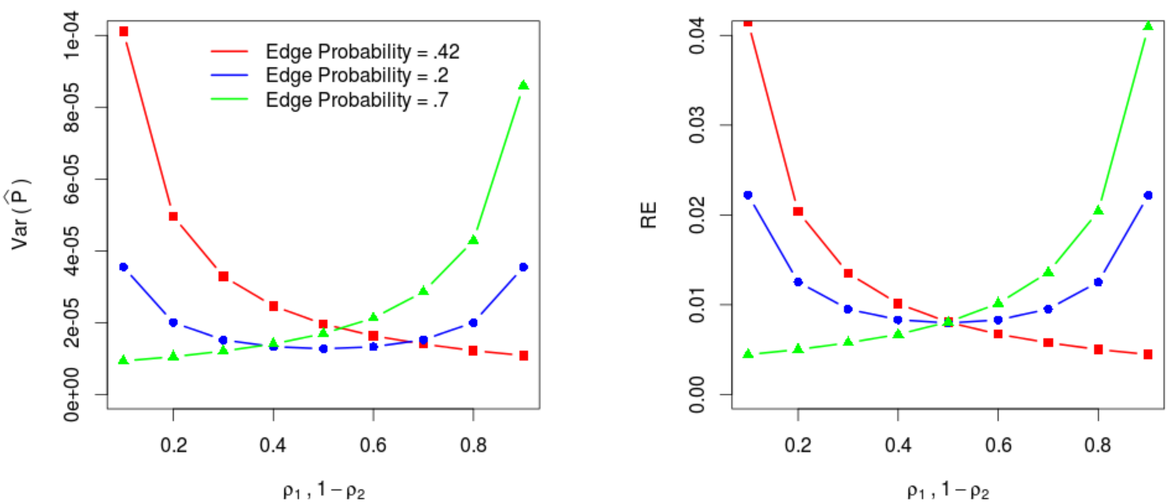

Figure 3: Simulated results for $\mathrm{Var}(\hat{P})$ (a) and RE (b) calculated from edges with associated edge probabilities. The simulated values for the variance and RE measurements deviated from the predictions with a mean of 3.7e-7, and 1.6e-4, respectively.

5 Real Data

6 Discussion