trying

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For the exposure, in this scenario, I will only use $x_{t(j)}$ and $x_{t(j-1)}$ to predict $x_{t(j+1)}$ and then the data generation process(DGP) is:

$$x_{t(j+1)} = g^X(x_{t(j)}, x_{t(j-1)})$$

for each time point, $x_{t(j)}$ will follow a Bernoulli distribution and the data generation model is(DGM):

$X_{t(j+1)} \sim bernoulli(logit(p_{t(j+1)}))$

$logit(p_{t(j+1)}) = \nu_t + \phi_{1,t}X_{t(j)} + \phi_{2,t}X_{t(j-1)}$

Here, ν_t means fixed effect for x at different time periods which is decided by the probability of having high count/texts in each time period.

for the outcome

The DGP is:

$$Y_{t(j)} = g^Y(X_{t(j)}, Y_{t(j-1)}, U_{t(j)})$$

The DGM is:

$$Y_{t(j)} = \zeta_t + \alpha_{t(j)}X_{t(j)} + \phi_t Y_{t(j-1)} + \eta_{t(j)}U_{t(j)} + \varepsilon_{t(j)}$$

ζ_t: fixed effect for Y at different time period

$U_{t(j)}$: other nonexposure covariates

$\varepsilon_{t(j+1)}$ $N(0, \sigma_t^2)$: error term

$U_{t(j+1)} = U_t^{\triangle} + \rho_{1,t}(U_{t(j)} - U_t^{\triangle}) + w_{1,t(j)}$ $w_t(j) \sim N(0, \sigma_{1,w}^2)$

$\eta_{t(j+1)} = \eta_t^{\triangle} + \rho_{2,t}(\eta_{t(j)} - \eta_t^{\triangle}) + w_{2,t(j)}$ $w_t(j) \sim N(0, \sigma_{2,w}^2)$