Response Memo

Response to Reviewer 1

> "The paper does not accurately characterize or analytically understand the latent space approaches employed by the work that is cited. For example Dorff and Ward (2013) do not use LATENTNET. LATENTNET is extremely outdated and is not the software used in much of the other work cited herein. This undermines much of the criticisms in the papers and raises a red flag that suggests the authors do not grasp the modeling approaches as deeply as they would present."

While we appreciate that the `latentnet` package is not the implementation most commonly used in political science, it is used outside of political science. We have made this point more clearly in the revised manuscript. Most importantly, our criticism is not specific to the implementation in `latentnet`, and we argue (again, more clearly in the revised manuscript), that our argument does not depend on the specific software implementation or parameterization used, and hence this criticism does not speak to our point, which is that that the LSM cannot adjust for unobserved confounders, even in a synthetic scenario designed to make this as easy as possible.

> "The authors are not up-to-date on the state of latent modeling in the field and have ignored more recent work (which addresses many of the concerns raised by the authors) particularly by Peter Hoff and Shahryar Minhas. Additionally, the progress made by the newly developed AMEN software is completely overlooked by this article."

We have added discussion of the AMEN package, which we were aware of, but again, does not apply to our argument for the same reason.

> "In that vein, authors identify a problem (e.g., collinearity between latent distance parameters and exogenous variables in the latentnet framework) and do not solve it nor discuss any recent work that tries to address this problem."

Our point is that when the measured covariates are *not* independent of the unobserved structure in the network, that estimating that structure using latent variables cannot adjust for any confounding. We are unaware of any work that attempts to tackle this problem and we furthermore consider the problem as we've posed it intractable for theoretical reasons, which we have elucidated more clearly in our revised version. In generally latent variables cannot be used to adjust the effects of measured covariates. In the case where the measured covariates are independent of any unmeasured structure, the LSM does no worse than standard models, as we show in our simulation.

Response to Reviewer 2

> "Yet, in their efforts to contextualize their research the authors seem to disregard or not be aware of notable differences between existing latent variable approaches. Specifically, much of the work they cite (e.g., Ward Siverson and Cao 2007, Ward, Ahlquist and Rozenas 2013, etc.) does not even use the type of latent variable model that the authors focus on in their paper. In fact, with the exception of a 2012 piece by Kirkland, I am not aware of any published political science work that actually uses the latent space model for network analysis the authors study here."

While this is true, it is orthogonal to our point, which is that the LSM, regardless of how the latent variables are parameterized, cannot adjust for unobserved network confounders. We chose the first formulation of the LSM to make our synthetic demonstration as understandable as possible. We

argue that it shows that even in the most ideal scenario, the LSM cannot adjust for confounders that are unmeasured. We have made the point that this behavior is independent of the parameterization of the latent variables more clear in the revised manuscript. While we certainly could have chosen any number of the variations of the LSM for our simulation, absent clear reasons to do so we do not believe that it is reasonable to expend the substantial computational resources necessary to expand the simulation.

> "The difference between these approaches has been shown to be consequential in a number of works. Hoff & Ward (2004) and Hoff (2005) detail the ways in which the GBME is different than the latent distance model that is employed in the latentnet package. Hoff (2008) explicitly discusses how the latent distance model confounds transitivity and stochastic equivalence (two types of third order interdependencies) in problematic ways that the latent factor model is able to avoid. The issue this paper seems most concerned with showing is that the latent distance model does not solve the problem of bias and inferential error relative to GLM for observed covariates. They do so through a well executed simulation exercise and the results are certainly compelling in favor of showcasing a shortcoming of the latent distance model. At the same time, this result is not very surprising. For the latent distance model we expect there to be some collinearity between covariates for which there is homophily and latent position. In theory, a weak prior on the covariate coefficients and a strong (tight) prior on the coefficients should minimize this effect, but at the cost of less expressiveness for latent positions."

We agree that the parameterization of the latent variables can affect what can be learned about omitted structure in the network, as suggested. However, this is unrelated to our point which is that it is not possible to adjust the estimates of the effect of observed covariates using a latent variable model that can represent unobserved structure. We argue more clearly in the revised manuscript that this is not a property of the Euclidean distance formulation we chose for expository simplicity.