Unbiased Estimation of Multi-Way Gravity Models

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Abstract :
Maximum likelihood estimators, such as the Poisson Pseudo-Maximum Likelihood (PPML), suffer from the incidental parameter problem: a bias in the estimation of structural parameters that arises from the joint estimation of structural and nuisance parameters. To address this issue in multi-way gravity models, we propose a novel, asymptotically unbiased estimator. Our method reframes the estimation as a series of classification tasks and is agnostic to both the number and structure of fixed effects. In sparse data environments - common in the network formation literature - it is also computationally faster than PPML. We provide empirical evidence that our estimator yields more accurate point estimates and confidence intervals than PPML and its bias-correction strategies. These improvements hold even under model misspecification and are more pronounced in sparse settings. While PPML remains competitive in dense, low-dimensional data, our approach offers a robust alternative for multi-way models that scales efficiently with sparsity.