School of Mathematical and Statistical Sciences
Arizona State University

M E M O R A N D U M

DATE: 04/01/2025

TO: Faculty and Students

FROM: Professor(s) Jeffrey Wilson
Chair/Co-Chairs of Adam Leighton
Defense for the PhD in Statistics
Committee Members
Carla van de Sande
Din Chen
Steven Baer
Yi Zheng

DEFENSE ANNOUNCEMENT

Candidate: Adam Leighton

Defense Date: April 11, 2025

Defense Time: 1:00 PM Location:: WXLR A106 - Wexler Hall (Tempe)

Virtual Meeting Link: https://asu.zoom.us/j/8171048353

Title: A Bayesian Generalized Method of Moments Model for Panel Data with Feedback Effects

Please share this information with colleagues and other students, especially those studying in similar fields. Faculty and students are encouraged to attend. The defending candidate will give a 40-minute talk, after which the committee members will ask questions. There may be time for questions from those in attendance. But, guests are primarily invited to attend as observers and will be excused when the committee begins its deliberations or if the committee wishes to question the candidate privately.

ABSTRACT
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ABSTRACT

Panel data, longitudinal data involving repeated observations of the same subjects over time, often exhibit complex correlation patterns within the outcome measurements. Additionally, relationships between the outcome at a given time and earlier covariates or those between the covariates at a given time and earlier outcomes (so-called feedback) may give rise to endogeneity, rendering many statistical modeling frameworks unreliable. It is crucial to account for all these sources of correlation when formulating statistical models since they can bias parameter estimates.

While researchers have developed Generalized Method of Moments (GMM) models that incorporate both the immediate and delayed effects of covariates on the outcome as well as the delayed effects of the outcome on future values of the covariates, this paper introduces a Bayesian GMM model that accounts for those same effects within a Bayesian statistical modeling framework to avoid the challenges that come with likelihood-based methods and to incorporate expert knowledge to improve the efficiency of estimation.

The proposed model is demonstrated on several simulated datasets representing a range of possible use-cases. The proposed semiparametric Bayesian model uses the quadratic objective function central to GMM to construct a pseudo-likelihood function which, when combined with prior distributions on the parameters and the state of the art software Stan with its Hamiltonian Monte Carlo sampling algorithm, lets the parameter space be explored efficiently. Beyond introducing the model itself, robustness and sensitivity checks of the proposed model are analyzed, it is compared to other popular statistical models, and possible extensions are discussed.