

# Thesis Abstract

Title of Thesis	Essays in Bayesian Econometrics
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**Abstract (within 1,500 words):**

This thesis consists of three essays on methodological contributions to Bayesian econometrics.

The first chapter proposes a new Bayesian inferential approach to local projections. A local projection is a statistical framework that accounts for the relationship between an exogenous variable and an endogenous variable, measured at different time points. Local projections are often applied in impulse response analyses and direct forecasting. While local projections are becoming increasingly popular because of their robustness to misspecification and their flexibility, they are less statistically efficient than standard methods, such as vector autoregression. In this study, I seek to improve the statistical efficiency of local projections by developing a fully Bayesian approach that can be used to estimate local projections using roughness penalty priors. The proposed priors, which are adapted from Bayesian splines, are generated from an intrinsic Gaussian Markov random field; that is, they induce random-walk behavior on a sequence of parameters. By incorporating such prior-induced smoothness, one can use information contained in successive observations to enhance the statistical efficiency of an inference. I compare the proposed approach with the existing approaches through a series of Monte Carlo experiments. I apply the proposed approach to an analysis of monetary policy in the United States, showing that the roughness penalty priors successfully estimate the impulse response functions and improve the predictive accuracy of local projections. [Computational Economics, Volume 55, Issue 2, pp. 629-651.]

The second chapter develops a computational method for the Bayesian version of generalized method of moments (GMM) in difficult situations. A GMM criterion can be viewed as a quasi-likelihood, being theoretically equivalent to the Laplace approximation of the true likelihood around its mode. Exploiting this feature, one can conduct a (quasi-)Bayesian inference by replacing true likelihood with a GMM criterion. There are cases where the number of moment conditions can be large. However, a GMM estimator is unreliable when the number of moment conditions is large,

that is, it is comparable or larger than the sample size. While a number of provisions for this problem is proposed in classical GMM literature, the literature on its Bayesian counterpart (i.e., Bayesian inference using a GMM criterion as a quasi-likelihood) has paid scant attention to this problem. This study fills this gap by proposing an adaptive Markov chain Monte Carlo (MCMC) approach to a GMM inference with many moment conditions. Particularly, this study focuses on the adaptive tuning of a weighting matrix on the fly. Our proposal consists of two elements. The first is the use of the nonparametric eigenvalue-regularized precision matrix estimator, which contributes to numerical stability. The second is the random update of a weighting matrix, which substantially reduces computational cost, while maintaining the accuracy of the estimation. A simulation study and real data application are then presented to illustrate the performance of the proposed approach in comparison with existing approaches. [arXiv preprint, arXiv: 1811.00722.]

The third chapter proposes a new Bayesian approach to infer average treatment effect. The approach treats counterfactual untreated outcomes as missing observations and infers them by completing a matrix composed of realized and potential untreated outcomes using a data augmentation technique. We also develop a tailored prior that helps in the identification of parameters and induces the matrix of the untreated outcomes to be approximately low rank. While the proposed approach is similar to synthetic control methods and other relevant methods, it has several notable advantages. Unlike synthetic control methods, the proposed approach does not require stringent assumptions. Whereas synthetic control methods do not have a statistically grounded method to quantify uncertainty about inference, the proposed approach can estimate credible sets in a straightforward and consistent manner. Our proposal approach has a better finite sample performance than the existing Bayesian and non-Bayesian approaches, as we show through a series of simulation studies. [arXiv preprint, arXiv: 1911.01287.]