Mengshan Xu

PUBLICATION:

1. “Score estimation of monotone partially linear index model” (with Taisuke Otsu), forthcoming in Journal of Nonparametric Statistics.

Abstract: This paper studies semiparametric estimation of partially linear single-index models with a monotone link function. Our estimator is an extension of the score-type estimator developed by Balabdaoui, Groeneboom, and Hendrickx (2019) for monotone single-index models, which profiles out the unknown link function by isotonic regression. An attractive feature of the proposed estimator is that it is free from tuning parameters for nonparametric smoothing. We show that our estimator for the finite-dimensional components is $\sqrt{n}$-consistent and asymptotically normal. Furthermore, by introducing an additional smoothing to obtain the efficient score, we propose an asymptotically efficient estimator for the finite-dimensional components. A simulation study illustrates the usefulness of the proposed method.

WORKING PAPERS:

1. “Empirical likelihood inference for monotone index model” (with Taisuke Otsu and Keisuke Takahata)

Abstract: This paper proposes an empirical likelihood inference method for monotone index models. We construct the empirical likelihood function based on a modified score function developed by Balabdaoui, Groeneboom, and Hendrickx (2019), where the monotone link function is estimated by isotonic regression. It is shown that the empirical likelihood ratio statistic converges to a weighted chi-squared distribution. We suggest inference procedures based on an adjusted empirical likelihood statistic that is asymptotically pivotal, and a bootstrap calibration with recentering. A simulation study illustrates the usefulness of the proposed inference methods.

2. “Improved estimation of dynamic models of conditional means and variances” (with Weining Wang and Jeffrey M. Wooldridge)

Abstract: Modelling dynamic conditional heteroscedasticity is the daily routine in time series econometrics. We propose a weighted conditional moment estimation to potentially improve the efficiency of the QMLE (quasi maximum likelihood estimation). The weights of conditional moments are selected based on the analytical form of optimal instruments, and we nominally decide the optimal instrument based on the third and fourth moments of the underlying error term. This approach is motivated by the idea of general estimation equations (GEE). We also provide an analysis of the efficiency of QMLE for the location and variance parameters. Simulations are conducted to show the better performance of our estimators.

RESEARCH IN PROGRESS:

1. “Causal inference under monotonicity”

This paper studies a range of estimators for causal models with binary treatments, where the propensity score is an unknown monotone increasing function of certain combinations of covariates. They include Inversed probability weighting, Blocking on the propensity score, Regression on the propensity score, and Matching on the propensity score. We use isotonic regression to estimate these propensity scores and show that the resulting semiparametric estimators have many desirable features in both theories and applications. We also study the doubly robust estimator, where both nuisance functions are estimated with isotonic regression. The underline assumption is that either the propensity score or the conditional mean function of potential outcomes is monotone increasing.

2. “Specification test under measurement error with multiple integrals”

This paper proposes a specification test for regression models with classic measurement errors in covariates. It compares the (multiple) integrals of the parametrically fitted and nonparametrically fitted functions. The latter is calculated with deconvolution techniques. The test statistics is a smoothed version of Stute (1997). The partial sum of residuals in Stute (1997) is replaced by (multiple) integrals due to the existence of measurement errors. We show that our test can detect local alternatives at a faster convergence rate than existing tests. In certain cases, the $n^{-1/2}$ rate can be obtained.

3. “Monotone GLS“ (with Taisuke Otsu and Yoichi Arai)

This paper proposes a feasible generalized least square estimator (FGLS), with the knowledge that the heteroskedastic conditional variance is a monotone increasing function of the covariates. Instead of specifying a parametric form of the GLS weighting matrix, we estimate it by regressing the square terms of OLS residuals on the covariates with isotonic estimation. We show that under mild conditions, our semiparametric FGLS estimator is asymptotically equivalent to the infeasible GLS estimator and therefore efficient.

4. “Optimal Treatment Choice for Time Series and Dynamic Network data” (with Toru Kitagawa and Weining Wang)

This paper aims at estimating the optimal treatment choice in a dynamic (time series) setting. The framework is based on the model-free causal inference for the dynamic setting and the empirical welfare maximization method. Using empirical process theory for dependent data, we develop the asymptotical upper bound and minimax lower bound of the difference in the target welfare functions under the estimated treatment choice rule and the theoretical optimal choice, and simulation results support our theories. In the application, we estimate the optimal monetary policies for several macroeconomic and financial market targets. We also plan to extend this optimal choice rule to the dynamic network.