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Desired Teaching: Econometrics

Comprehensive Examinations Completed:
2016 (Oral): Econometrics, Industrial Organization
2015 (Written): Microeconomics, Macroeconomics

Dissertation Title: *Essays on Robust Methods in Econometrics*

Committee:
Professor Donald Andrews (Co-Chair)
Professor Timothy Armstrong (Co-Chair)
Professor Xiaohong Chen

Expected Completion Date: May 2021

Degrees:
Ph.D., Economics, Yale University, 2021 (expected; two terms of parental leave)
M.Phil., Economics, Yale University, 2017
M.A., Statistics, Yale University, 2017
M.A., Economics, Seoul National University, 2014
B.A., Economics and B.A., Business Administration, Seoul National University, 2012

Fellowships, Honors and Awards:
University Dissertation Fellowship, Yale University, 2020-2021
Carl Arvid Anderson Prize Fellowship, Cowles Foundation, 2019-2020
Hoffman Fellowship, Yale University, 2015-2016
University Fellowship, Yale University, 2014-2019
Samsung Scholarship, Samsung Foundation, 2014-2019
Cowles Foundation Fellowship, Yale University, 2014-2018

Teaching Experience:

Spring 2019, Teaching Assistant to Prof. Xiaohong Chen, Econometrics III (Ph.D.)
Fall 2018, Teaching Assistant to Prof. Donald Andrews, Introduction to Probability and Statistics (undergraduate)
Spring 2017, Teaching Assistant to Prof. Yuichi Kitamura, Econometrics III (Ph.D.)

Research and Work Experience:

Research Assistant to Prof. Timothy Armstrong, Yale University, 2017
Research Assistant to Prof. Xiaohong Chen, Yale University, 2016
Research Assistant to Prof. Joseph Altonji, Yale University, 2015

Publications:

"The Identification Power of Smoothness Assumptions in Models with Counterfactual Outcomes" (with Wooyoung Kim, Koohyun Kwon, and Sokbae Lee), 2018, *Quantitative Economics*, 9, 617-642

"International Trends in Technological Progress: Evidence from Patent Citations, 1980-2011" (with Jihong Lee and Sokbae Lee), 2017, *Economic Journal*, 127, F50-F70

Working Papers:

"Optimal Shrinkage Estimation of Fixed Effects in Linear Panel Data Models" (November 2020), *Job Market Paper*

"Inference in Regression Discontinuity Designs under Monotonicity" with Koohyun Kwon (November 2020)

"Adaptive Inference in Multivariate Nonparametric Regression Models Under Monotonicity" with Koohyun Kwon (November 2020)

"Inference in Moment Inequality Models That Is Robust to Spurious Precision under Model Misspecification" with Donald Andrews (October 2019), revision requested by *Review of Economic Studies*

Work in Progress:

"Optimal Inference in Regularized Regression Models" with Timothy Armstrong and Michal Kolesar

Referee Service:

Econometrica, Review of Economic Studies, Journal of Business and Economic Statistics

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References:

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Dissertation Abstract

Optimal Shrinkage Estimation of Fixed Effects in Linear Panel Data Models [Job Market Paper]

In panel data models, fixed effects capture unobserved heterogeneity at the specified level, and thus have interesting economic interpretations in numerous contexts. Typically, the number of fixed effects to be estimated is very large, whereas the effective sample size available for the estimation of each fixed effect is relatively small. These two features make accurate estimation of the fixed effects challenging.

I propose an estimator of the fixed effects in linear panel data models that has desirable risk properties. The estimator is obtained by shrinking the least squares estimator—the coefficient on the dummy variable corresponding to the fixed effect unit—in an optimal way. The fixed effects are allowed to vary with time and to be serially correlated, in which case the shrinkage occurs in a way that it incorporates the underlying correlation structure. The proposed estimator is shown to be optimal in mean squared error under minimal assumptions, within a class of shrinkage estimators. As a result, the proposed estimator asymptotically dominates most estimators that have been commonly used in applied research.

The estimator is derived by postulating a Gaussian model of the true fixed effects with unknown mean and variance, which I refer to as the hyperparameters. Under this model, the expectation of the true fixed effect conditional on the least squares estimator provides a class of shrinkage estimators indexed by the hyperparameters. The hyperparameters are tuned by minimizing an estimate of the risk, the mean squared error, of the corresponding estimator. Because the risk estimate is close to the true loss under minimal assumptions and, importantly, without any parametric distributional assumptions on either the true fixed effects or the idiosyncratic error terms, the optimality of the proposed estimator holds under a wide range of data generating processes. This is in contrast with the more conventional Empirical Bayes (EB) methods, where an optimality result is possible only under specific distributional assumptions. A simulation study demonstrates that the risk improvement over EB estimators can be significant when the distributional assumptions of EB methods are violated. Moreover, the improvement comes with only a small price; even when such distributional assumptions are satisfied, the risk of the estimator is very close to that of EB estimators.

Using administrative data on the public schools of New York City, I show that the proposed estimator makes an empirically relevant difference. I measure teacher value-added using the proposed estimator, and revisit the policy exercise of releasing the bottom 5% of the teachers according to the estimated fixed effects. The composition of the released teachers changes by 20% by using the proposed method rather than the conventional methods.

Misspecified Moment Inequality Models: Diagnostics and Inference, with Donald Andrews

Model misspecification tests are subject to the problem that absence of evidence is not evidence of absence. This paper develops new diagnostics for model misspecification that do not suffer from this problem in moment inequality models. Standard tests and confidence sets in the moment inequality literature are not robust to model misspecification in the sense that they exhibit spurious precision when the identified set is empty. This paper introduces tests and confidence sets that provide correct asymptotic inference for a pseudo-true parameter in such scenarios, and hence, do not suffer from spurious precision.

Inference in Regression Discontinuity Designs under Monotonicity, with Koohyun Kwon

We provide an inference procedure for the sharp regression discontinuity design (RDD) under monotonicity, with possibly multiple running variables. Specifically, we consider the case where the true regression function is monotone with respect to (all or some of) the running variables and assumed to lie in a Lipschitz smoothness class. Such a monotonicity condition is natural in many empirical contexts, and the Lipschitz constant has an intuitive interpretation. We propose a minimax two-sided confidence interval (CI) and an adaptive one-sided CI. For the former, the researcher is required to choose a Lipschitz constant where she believes the true regression function to lie in. Once chosen, the bandwidth automatically follows, and the resulting CI has uniform coverage and obtains the minimax optimal length. When the researcher wishes to maintain maximum credibility with respect to the choice of the function space, the adaptive one-sided CI can be used. This CI can be constructed to maintain coverage over an arbitrarily large Lipschitz class, possibly over all monotone functions. The monotonicity makes it possible for the (excess) length of the CI to adapt to the true Lipschitz constant, which enables the researcher to conduct non-conservative inference. Overall, the proposed procedures make it easy to see under what conditions on the underlying regression function the given estimates are significant, which can add more transparency to research using RDD methods.