MIT Economics

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DOCTORAL STUDIES

Massachusetts Institute of Technology (MIT)
PhD, Economics and Statistics, completed August 2019
DISSERTATION: *"Geometric Methods in Econometrics and Statistics"*

DISSERTATION COMMITTEE AND REFERENCES

Professor Whitney Newey
MIT Department of Economics
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Professor Anna Mikusheva
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Professor Victor Chernozhukov
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Professor Alberto Abadie
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PRIOR EDUCATION

Columbia University, New York, NY — 2011-2012
G1 of Economics PhD program
University of Nevada, Las Vegas, NV — 2007-2011
BA in Mathematics, BA in Economics, MS in Statistics

CITIZENSHIP USA, Russia **GENDER:** Male

LANGUAGES English (fluent), Russian (native), German (beginner)

FIELDS Econometrics, Statistics

TEACHING EXPERIENCE

14.382 Econometrics Teaching Assistant to Professor Victor Chernozhukov	2015-2018
14.386 Topics in Econometrics Teaching Assistant to Professors Whitney Newey Teaching Assistant to Professors Alberto Abadie	2018
14.381 Statistical Methods in Economics Teaching Assistant to Professor Michal Kolesár Teaching Assistant to Professor Isaiah Andrews	2016
14.385 Nonlinear Economic Analysis Teaching Assistant to Professor Isaiah Andrews Teaching Assistant to Professors Alberto Abadie	2016
14.381 Statistical Methods in Economics Teaching Assistant to Professor Anna Mikusheva	2015
14.384 Time Series Analysis Teaching Assistant to Professor Anna Mikusheva	2015

RELEVANT POSITIONS

Visiting Lecturer at Department of Economics of Dartmouth College	2020
Postdoctoral Research Associate at MIT Institute for Data, Systems, and Society	2019-2020
Consultant at NBER, Cambridge, MA References: Prof. Simon Jäger and Prof. Benjamin Schoefer	2018
Research Assistant to Professor Matthew Gentzkow and Professor Jesse Shapiro	2015-2016
Research Assistant to Professor Victor Chernozhukov	2015
Research Assistant to Professor Whitney Newey	2014

FELLOWSHIPS, HONORS, AND AWARDS

Tinbergen Workshop "Machine Learning for Economics and Econometrics" Travel Grant	2019
Castle Krob International Fellowship	2013
Erdős Number 3	2012
Charles & Selma Knauss Scholarship	2009
Marie Barbara Woodrich Scholarship	2008
Mary Dougherty Honors Scholarship	2007

PROFESSIONAL ACTIVITIES

Invited Academic Presentations:

"On Counterfactual Analysis of Differentiable Functionals"	
International Econometrics PhD Conference at the Econometric Institute, Erasmus University Rotterdam	2019
Young Economists Symposium, Columbia University in New York City	2019
Econometric Society - North American Winter Meetings in San Diego (scheduled)	2020

Refereeing: Econometric Theory

PUBLICATIONS

"Cordial Sets of Hypercubes" (with Ebrahim Salehi and Suhadi Wido Saputro), *Bulletin of the ICA,* 2015
"Product Cordial Sets of Long Grids" (with Ebrahim Salehi), *Ars Combinatoria*, 2012

RESEARCH PAPERS

"On Counterfactual Analysis of Differentiable Functionals" (Job Market Paper)
Counterfactual probability distributions are important elements of policy analysis, Oaxaca-Blinder style decomposition analysis, robustness and sensitivity analysis in empirical economics. In this paper we solve two complementary problems of statistical counterfactual analysis: (i) Given a counterfactual change in a scalar functional of a probability distribution, we describe the counterfactual distributions that have such an effect on the functional and deviate minimally from the status quo distribution in a continuous fashion. (ii) Given a counterfactual distribution, we compute the change in a statistical functional relative to the status quo distribution by integrating its local changes along a path from the status quo to the counterfactual distribution. In combination, these two exercises provide a general framework for measuring the local and global relationship between (structural) estimators of parameters or counterfactuals and descriptive statistics or specific features of the data. To solve these problems, we use von Mises calculus (i.e. influence functions), information geometry, optimal transport, and introduce gradient score flows. We define a unique path of counterfactual distributions with a combination of a statistical functional and a metric of distance or cost on the nonparametric manifold of probability distributions via the gradient flow of the functional. We describe the gradient flow paths obtained with the Fisher-Rao information metric, 2-Wasserstein optimal transport metric, and their weighted variants.

"Sensitivity of Regular Estimators" (arXiv:1805.08883)
This paper studies local asymptotic relationship between two scalar estimates. We define the sensitivity of a target estimate to a control estimate to be the directional derivative of the target functional with respect to the gradient direction of the control functional. The gradient direction depends on the metric of distance between probability distributions. Sensitivity of the information metric on the model manifold is the asymptotic covariance of regular efficient estimators. Sensitivity of a general policy metric on the model manifold can be obtained from the influence functions of regular efficient estimators. Policy sensitivity has a local counterfactual interpretation, where the ceteris paribus change to a counterfactual distribution is specified by the combination of a control functional and a Riemannian metric on the model manifold. The functional has the economic interpretation of policymaker's preferences, and the metric has the economic interpretation of the cost of counterfactual distributions.

RESEARCH IN PROGRESS

"General Heterogeneity Welfare Bounds" (joint work with Max Cytrynbaum)
This paper develops nonparametric bounds on the average surplus measures of consumer welfare. We do not restrict unobserved individual heterogeneity or the number of goods. Bounds are based on cross-section data on the marginal

distributions of the population demand system, the Axioms of Revealed Preferences and shape restrictions assumptions of monotonicity and convexity about individual preferences. Consumer surplus depends on varying price and income for an individual, and its expectation is not identified from the marginal distributions of demand. We obtain bounds on the average welfare effects of price changes by bounding the individual surplus based on finitely many choices, and coupling the marginal distributions of demand into a random utility model.

"On Semiparametric Bound of Asymptotic Variance for Conditional Moment Restrictions" (joint work with Whitney Newey)
There is given a vector of moment functions that depend on the data and a parameter. The restrictions on the distribution of the data are that the conditional expectation of this function has a unique zero for some value of the parameter. The statistical functional of the distribution is defined to be this value of the parameter. In this note we characterize the tangent space of the semiparametric model described by conditional moment restrictions. We derive the efficient influence function by solving the Riesz representation equation for the pathwise derivative of the functional and projecting it onto the tangent space of the model. The semiparametric efficiency bound for the functional is the smallest asymptotic variance of any regular estimator sequence of this parameter, that is any estimator whose asymptotic distributions are sufficiently uniform in the distribution of the data. This bound is the variance of the efficient influence function.

"Inference for Functionals of Continuous Exponential Tilting"
Continuous exponential tilting (CET) is a path of counterfactual distributions, obtained by solving a score flow differential equation with a status quo distribution as the initial position. We characterize the influence function for the counterfactual change in a functional along the CET path. The variance of the influence function is the semiparametric efficiency bound of the asymptotic variance of any regular estimator of this counterfactual based on data generated by the status quo distribution. We construct uniform confidence bands for the counterfactual change along the CET path and provide conditions for the validity of bootstrap.

"Inference for Nonsmooth Nonlinear Models with Measurement Error"
We propose an estimator for nonlinear and nonsmooth moment restriction models with measurement errors in the covariate, when repeated observations are available for each mismeasured variable. The independent repeated observations are used to cancel out the measurement error, using analytic properties of the Fourier transform, and identify the moments of the model with respect to the distribution of the unobserved true covariates. We establish asymptotic normality and derive the rates of convergence of the proposed estimator as a function of the smoothness of the moment conditions and densities of the true variables and measurement errors.

"Bernstein-von Mises Theorem for High-Dimensional Quasi-Bayesian Estimation" (joint work with Victor Chernozhukov)

We develop Bayesian procedures for estimation, computation and inference for a low-dimensional (target) parameter of interest in the presence of a high-dimensional nuisance parameter that is estimated using modern nonregular high-dimensional methods. We construct a marginal Quasi-posterior distribution over the target parameter space that can be approximated (in total variation norm) by the Gaussian distributions centered at the orthogonalized influence function of the target parameter and a covariance that is the inverse of the efficient information matrix. Bayes estimators based on such a posterior distribution are regular and efficient, and can be computed with modern Monte Carlo Markov Chain tools.